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Automated Poultry Farm with Network Monitoring

مزرعة الدواجن الآلية والمراقبة بالشبكات

A Project Submitted In Partial Fulfillment for the Requirements of the Degree of B.Sc. (Honor) In Electrical Engineering (Control)

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الآية

{أَوَلَمْ يَرَوْا أَنَّا خَلَقْنَا لَهُمْ مِمَّا عَمِلَتْ أَيْدِينَا أَنْعَامًا فَهُمْ لَهَا مَالِكُونَ (71) وَذَلَّلْنَاهَا لَهُمْ فَمِنْهَا رَكُوبُهُمْ وَمِنْهَا يَأْكُلُونَ (72) وَلَهُمْ فِيهَا مَنَافِعُ وَمَشَارِبُ أَفَلَا يَشْكُرُونَ (73)}

[سورة يس: الآيات 71-73]

DEDICATIONS

This study is lovingly dedicated to our parents for their emotional and financial support, our brothers, our sisters, and our friends whose has been constant source of inspiration for us. They have given us the drive and the discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been made possible.

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ABSTRACT

In contemporary world automation plays a vital role. This paper focuses on an automation of poultry farm by using Arduino and network monitoring. In this paper environmental parameters of poultry farm such as temperature and humidity, are monitored and controlled automatically in order to increase the growth of chicken. By connecting all the sensor modules to the Arduino all sensor values are acquired then using Wi-Fi module it will be uploaded to the web page. The person in-charge of the poultry farm can get the internal environmental situation of poultry farm through PC or mobile phone using internet. This system will control temperature, humidity, water level and feeding with the help of cooling fan, exhaust fan, cooling pad and DC motor without any human interface. Based on the threshold values it will switch on the devices. Thus this system design provides automated poultry, reduces man power and increases production of healthy chicken.

المستخلص

في العالم المعاصر التحكم الآلي يلعب دورا مهما جدا. هذا البحث يركز على التحكم الآلي في مزارع الدواجن وذلك باستخدام تقنيات التحكم الذكي و ربطها بالشبكات. المتغيرات المناخية تم ضبطها كالحرارة و الرطوبة لتتم آليا و مراقبتها باستخدام الشبكات وذلك لزيادة الإنتاجية. وذلك بربط جميع المحساسات بالمعالج و ضبط قيمتها ثم ربطها بالشبكة ويمكن مراقبتها عن طريق صفحة في الإنترنت. هذا النظام يستطيع التحكم في كل من درجة الحرارة و الرطوبة و التغذية ايضا من دون تدخل اي انسان. ولهذا فان هذا النظام يقلل من القوى العاملة و يزيد من الإنتاجية بشكل كبير.

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LIST OF ABBREVIATIONS

AC	Alternating Current
ASP	Active Server Pages
AVR	Advanced Virtual Risc
BSD	Berkeley Software Distribution
°C	Celuis
CeNSE	Central Nervous System for the Earth
CGI	Computer generated imagery
Cm	Centimeter
COM	Component Object Model
CORBA	Common Object Request Broker Architecture
CPU	Central Processing Unit
DC	Direct Current
DOM	The Document Object Model
GND	Ground
GPRS	General Packet Radio Service
HMI	Human Machine Interface
HTML	Hyper Text Markup Language
HTTP	The Hypertext Transfer Protocol
IBM	International Business Machines
ICSP	In Circuit Serial Programming
ICT	Information and Communications Technology
IDE	Integrated Development Environment
IIS	Internet Information Services
IMAP	Internet Message Access Protocol
I/O	Input / Output
IP	Internetworking Protocol
ISO	International Standards Organization
KB	Kilo Byte
LAN	Local Area Network
LCD	Liquid Crystal Display
LDAP	The Lightweight Directory Access Protocol
LED	Light Emitting Diode
Ma	Milli Ampere
MEM	Micro Electronic Mechanical
NTC	National Telecommunication Corporation
ODBC	Open Database Connectivity
OOP	Object-oriented programming
OSI	Open System Interconnection
PC	Personal Computer
PHP	Personal Home Page
POP	Post Office Protocol
PWM	Pulse Width Modulation

RAM	Read Access Memory
RH	Relative Humidity
RISC	Reduced Instruction Set Computer
ROM	Read Only Memory
RTC	Real Time Clock
SMS	Short Message Service
SPI	Serial Peripheral Interface bus
SQL	Structured Query Language
TCP	The Transmission Control Protocol
TV	Television
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
WPAN	Wireless Personal Area Networks
WSN	Wireless Sensor Network
XHTML	Extensible Hypertext Markup Language
XML	Extensible Markup Language

CHAPTER ONE

INTRODUCTION

1.1 General Concepts

Automation is the use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. Automation is the answer to Sudan’s pursuit of being a world-class industrial competitor. The Sudanese farms are slowly beginning to feel the stimulus for the instrumentation, control and automation industry. Sudan automation is advancing at a fast pace, yet it is one area that can never be achieved and admired – it is something that needs constant innovation and identification of trends in technology, and the innovations that thrust the implementation of automation in other countries. Sudan, as one of the world’s fastest growing economies based on agriculture and farming, has not taken to technology at a rather quick pace. Day by day automation technologies come up with new and innovative Ideas, smart poultry farming focused on regulating all environmental parameters like temperature, humidity, feeding, lighting which effects on the growth of the chickens. If chickens may get the suitable atmosphere and proper food then it may grow rapidly, and health of chickens will be good so the weight of the chickens will be increased. Modern monitoring technologies can provide a scientific management basis for poultry farm managers and help to raise management efficiency and lower production costs. From the last few decades, around the globe, there has been an increased level of awareness regarding the food safety and there has been a high demand for better quality food. This has forced many countries to adopt new protocols to change all manual farms into automated farms. In this way smart poultry farm has a great impact on increasing growth of chicken. This paper focused on modern technologies for a poultry farming to control all environmental parameters like temperature, humidity, which effects on the growth of the chickens. If the environmental condition is not up to the mark then there may be harmful to digestive, respiratory and behavioral change in the chickens. If chickens may get the suitable atmosphere and proper water then it may grow rapidly and health of chickens will be good so the weight of the chickens will be increased. One of the key roles involved in the development of human civilization is in the area of agriculture. With the continuing increase in the world’s population, the demand for food supply is extremely raised. Thus, not just farmers nor agriculturists, but also researchers have put considerable effort into a number of techniques to increase food production with an efficient return-of-investment methodology. Automation is increasingly important in modern poultry, reducing dependence on labor and liberating workers from constant work increasing management scale and efficiency, fulfilling the precision and consistency of product quality control, enabling enforceable traceability as part of food safety efforts – all of which can help achieve agricultural sustainability. Data communication and networking are changing the way we do business and the way we live. Business decisions have to be made ever more quickly, and the decisions makers require immediate access to accurate information. Nowadays the internet is taking over the whole industrial and every aspect of life, so if we combined the automation technology and the internet technology we will have the ultimate combination in industry. The Internet can ease the process of observation and monitor the farm remotely, so no matter where you are you can always check your farm, and with more development you can even control your farm remotely.

1.2 Problem Statement

The poultry industry is growing larger, and it requires more work and effort, hence the poultry is very sensitive. Without advanced technology the perfect environment cannot be achieved, which means no good products can be obtained.

1.3 Objectives

The main objectives are:

- Build and design a Control system to regulate temperature, light and humidity for the day and nighttime patterns and minimize the effects of environmental fluctuations caused by sudden changes, and the feeding timing.
- Minimizing the need for human disruption of the hen's environment.
- Design monitoring system for the poultry's parameters through the network web page, it provides great utility for the user as they can access the information.
- Design Alarm alerts for high temperature.
- Bring the awareness to the public about the development of the new technology which the automated poultry and network monitoring can be used to increase the production.

1.4 Methodology

The design had been done using the constructive methodology and it's based on a series of predominantly primary sources and the physical components of the automatic control system had been defined, such as: fans, motors, sensor, light emitting diode (LED), liquid crystal display (LCD) and Arduino. These components were assembled to create an automatic control system for the poultry farm; wireless fidelity (WIFI) module and personal computer (PC) for the monitoring system. The following steps were done:

- Visited and worked on a poultry farm in Taiba area.
- Collect all the important data about environmental parameters.
- Look for related articles about the poultry farm design.
- Look for several ideas regarding the implementation of the automatic control system in the poultry industry.
- Study the computer network to design the monitoring system.
- Consult and conduct an interview with some professionals and experts Agriculturist.
- Collect primary build materials.
- Build Adriano microcontroller program to control the poultry farm.
- Applied further improvement or adjustment to the prototype for more testing and analyzing.

1.5 Project layout

This study consist of five chapters: Chapter One gives an introduction to the principles of the work, in addition its reasons, motivation, objectives and methodology. Chapter Two is about the literature review in automatic control system and poultry farming.Chapter Three discuss the network systems and its applications. Chapter Four deals with the system design and the prototype of the poultry farm. Finally, Chapter Five provides the conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

At this point of time –the early years of the twenty first century- the world reached the point where it's needed to realize that the technology advancement must be first applied in an agricultural way. Hence the poultry farming now is taking a big part of life, and helping the economical and agricultural both, so the modern theories must be applied to this part. The automation now took a big place in the industrial work, so if this theory is applied to the poultry there is no question it will advance with the aid of it. And also the network took its own part in the industrial platform, hence it can also help with the data communication and the monitoring. If these two theories are applied in the poultry, then the poultry industry shall reach its peak, in production, quality, and it's security.

2.2 Automatic Control Systems

One of the most commonly asked questions by a novice on a control system is: What is a control system? To answer the question, we can say that in our daily lives there are numerous "objectives" that need to be accomplished. For instance, in the domestic domain, it’s needed to regulate the temperature and humidity of homes and buildings for a comfortable living. For transportation, its need to control the automobile and airplane to go from one point to another accurately and safely. Industrially, manufacturing processes contain numerous objectives for products that will satisfy the precision and cost effectiveness requirements [1].Automatic control is one of the today’s most significant areas of science and technology. This can be attributed to the fact that automation is linked to the development of almost every form of technology.

By its very nature, automatic control is a multidisciplinary subject; it constitutes a core course in many engineering departments, such as electrical, electronic, mechanical, chemical, and aeronautical. Automatic control requires both a rather strong mathematical foundation, and implementation skills to work with controllers in practice. An automatic control system is a combination of components that act together in such a way that the overall system behaves automatically in a pre-specified desired manner. A close examination of the various machines and apparatus that are manufactured today leads to the conclusion that they are partially or entirely automated, e.g., the refrigerator, the water heater, the clothes washing machine, the elevator, the TV remote control, the worldwide telephone communication systems, and the Internet. Industries are also partially or entirely automated, e.g., the food, paper, cement,carindustries,and many others, such as control of position or velocity, temperature, voltage, pressure, fluid level, traffic,and office automation, computer-integrated manufacturing, and energy management for buildings. All these examples lead to the conclusion that automatic control is used in all facets of human technical activities and contributes to the advancement of modern technology [2].

2.2.1 Advantages of automatic control system

The distinct characteristic of automatic control is that it reduces, as much as possible,the human participation in all the aforementioned technical activities. This usually results in decreasing labor cost, which in turn allows the production of more goods and the construction of more works. Furthermore, automatic control reduces work hazards, while it contributes toreducing working hours, thus offering to the working people a better quality of life.

2.2.2 Microcontroller

A microcontroller is a single chip computer. Micro suggests that the device is small, and controller suggests that the device can be used in control applications. Another term used for the microcontroller is embedded controller, since most of the microcontrollers are built into (or embedded in) the devices they control. While people quickly recognized and exploited the computing power of the microprocessor, they also saw another use for them, and that was in control. Designers started putting microprocessors into all sorts of products that had nothing to do with computing. When the need is not necessarily for high computational power, or huge quantities of memory, or very high speed. A special category of microprocessor emerged that was intended for control activities, not for crunching big numbers. After a while this type of microprocessor gained an identity of its own, and became called a microcontroller. The microcontroller took over the role the role of the embedded computer in embedded systems. What distinguishes a microcontroller from a microprocessor that the microcontroller needs to be able to compute, although not necessarily with big numbers. But it has other needs as well. Primarily, it must have excellent input/output capability. Because many embedded systems are both size and cost conscious, it must be small, self-contained and low cost. Nor will it sit in the nice controlled environment that a conventional computer might expect. No, the microcontroller may need to put up with the harsh conditions of the industrial or motor car environment, and be able to operate in extremes of temperature. A generic view of a microcontroller is essentially; it contains a simple microprocessor core, along with all necessary data and program memory. To this it adds all the peripherals that allow it to do the interfacing it needs to do. These may include digital and analog input and output, or counting and timing elements. Other more sophisticated functions are also available. Like any electronic circuit the microcontroller needs to be powered, and needs a clock signal (which in some controllers is generated internally) to drive the internal logic circuits. By the developing in a microcontroller appears anew type of microcontroller called Arduino.

- **Microcontroller application**

Microcontroller applications are found in many life filed, for example in Cell phone, watch, recorder, calculators, mouse, keyboard, modem, fax card, soundcard, battery charger, door lock, alarm clock, thermostat, air conditioner, television (TV) Remotes, in Industrial equipment like Temperature and pressure controllers, counters and timers.

2.2.3Arduino

Arduino is an open-source physical computing platform based on simple I/O board and a development environment that implements the processing language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer. There have been a number of Arduino versions; all based on 8-bit Atmel advanced virtual RISC (AVR) Reduced Instruction Set Computer (RISC) microprocessor. The first board was based on the ATmega8 running at a clock speed of 16 MHz with 8KB flash memory; later boards such as the Arduino NG-plus and the Decimal (Italian for 10,000) used the ATmega168 with 16 KB flash memory. The most recent Arduino versions, Duemilanove and Uno, use the ATmega328 with 32 KB flash memory and can be switch automatically between universal serial bus(USB) and direct current (DC) power. For projects requiring more I/O and memory, there's the Arduino Mega1280 with 128 KB memory or the more recent Arduino Mega2560 with 256 KB memory. The boards have 14 digital pins, each of which can be set as either an input or output, and six analog inputs. In addition, six of the digital pins can be programmed to provide a Pulse Width Modulation (PWM) analog output. A variety of communication protocols are available, including serial, serial peripheral interface bus (SPI), and 12C/TWI. Included on each board as standard features are an In-Circuit Serial Programming (ICSP) header and reset button. Specialist boards called shields can expand the basic functionality of the Arduino; these can be stacked on top of each other to add even more functionality[3].

2.3 Poultry Farming

Poultry farming means 'raising various types of domestic birds commercially for the purpose of meat, eggs and feather production'. The most common and widely raised poultry birds are chicken. About 5k million chickens are being raised every year as a source of food (both meat and eggs of chicken). The chickens which are raised for eggs are called layer chicken, and the chickens which are raised for their meat production are called broiler chickens, in a word commercial poultry farming is very necessary to meet up the demand of animal nutrition (eggs and meat). Commercial poultry farming is also very profitable. And commercial poultry farming business is one of the traditional business ventures.

- **Broiler poultry farming:**

Chickens reared for meat are called broilers or broiler chickens. The broiler industry has grown due to consumer demand for affordable poultry meat. Breeding for particular traits and improved nutrition have been used to increase the weight of the breast-muscle. Commercial broiler chickens are bred to be very fast growing in order to gain weight quickly; broilers only live for several weeks before they are slaughtered.

- **Poultry housing**

Good and suitable housing play a vital role in raising all types of poultry birds. Some birds grow and live happily on the floor of poultry house and some in cages. Depending on the birds, you have to make a suitable house for your birds and ensure availability of all types of necessary facilities for them. Consider the following aspects while building houses for your poultry birds.

- **Indoor raising methods**

In this method broilers are kept inside a house. In this system the broilers are kept in a large house and they become suitable for consumption within their 5 to 6 weeks of age. These types of poultry houses are well equipped with mechanical systems for delivering the feed and water to the poultry birds. Well ventilation system, coolers and heaters

2.3.1 Poultry management

The aim of management is to provide the conditions that ensure optimum performance of the birds, given reasonable conditions; broiler hens rely on careful management of ventilation, light and nutrition.

- **Ventilation**

All poultry houses need some form of ventilation (as shown in Figure 2.1) to ensure an adequate supply of oxygen, while removing carbon dioxide, other waste gases and dust. In commercial operations, minimum ventilation is often practiced in colder climates, but not generally in tropical ones. In large-scale automated operations, correct air distribution can be achieved using Tunnel ventilation. Tunnel ventilation is the most effective ventilation system for large houses in hot weather.

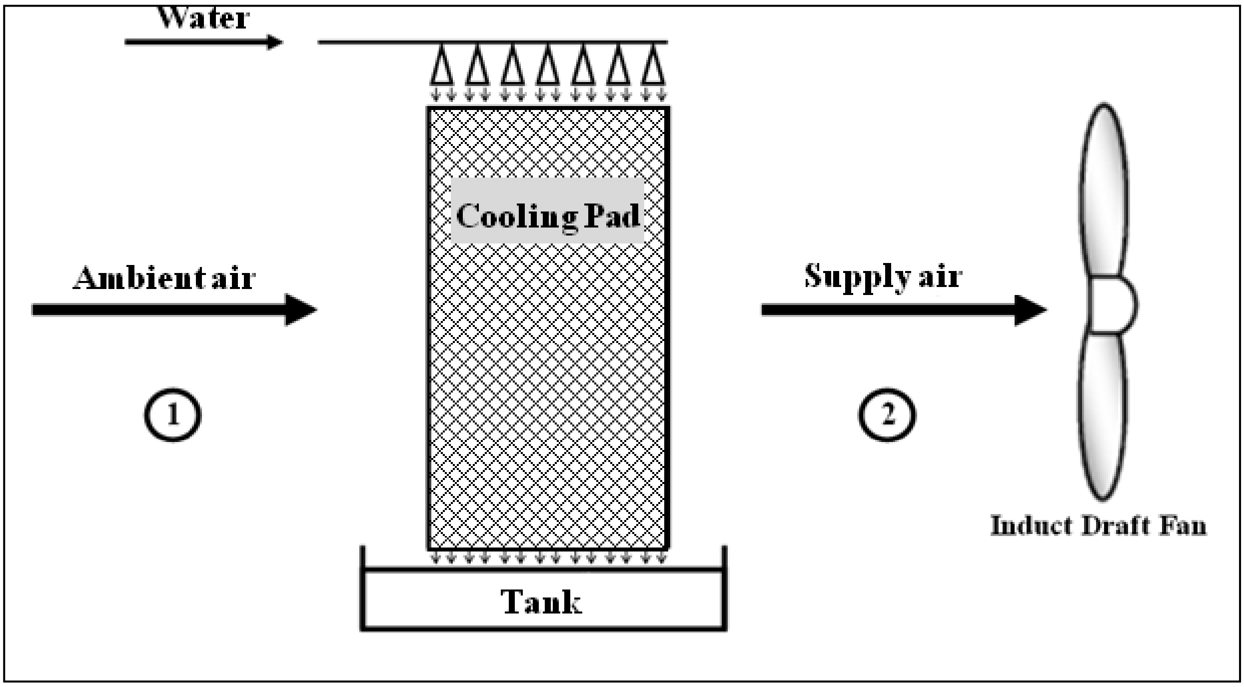

Figure (2.1): Illustration of the ventilation process.

- **Tunnel ventilation**

These systems are popular in hot climates. Exhaust fans are placed at one end of the house or in the middle of the shed, and the air is drawn through the length of the house, removing heat, moisture and dust. Evaporative cooling pads are located at the air inlets. The energy released during evaporation reduces the air temperature, and the resulting airflow creates a cooling effect, which can reduce the shed temperature by 10 °C or more, depending on humidity. Maximum evaporation is achieved when water pumps are set to provide enough pad moisture to ensure optimum water evaporation. If too much water is added to the pads, it is likely to lead to higher relative humidity and temperatures in the shed as shown in Figure (2.2).

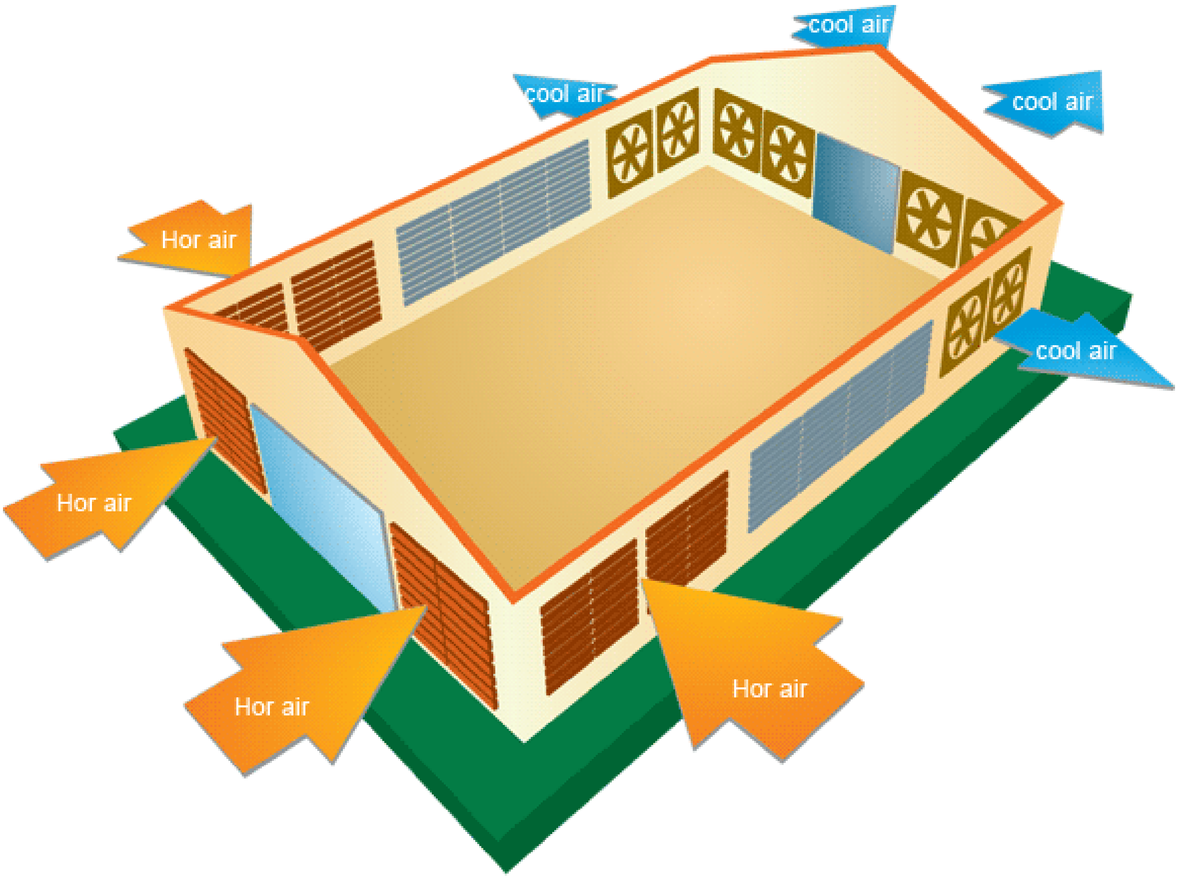

Figure (2.2): Poultry tunnel ventilation.

- **Temperature schedule**

The temperature is scheduled to the certain age of the chicken, and it's calculated by the weeks, the average broiler farm takes three weeks till the chicken is ready to slaughter (three weeks after the two weeks of the nursery).The table (2.1) below shows the weeks and the perfect temperature and humidity for the broiler chickens.

Table (2.1): Temperature and humidity for poultry

Age (weeks)	Temperatures (C°)	Relative humidity (%)
1	33	70
2	28	75
3	25	65

- **Lighting**

Light is an important management technique in broiler production. Traditionally, it has been assumed that using long day lengths in management schemes allowed maximum feeding time and as a consequence, maximum growth rate. Lighting programs in broiler production have evolved over the years, with success in improving live performance. The relatively recent and rapid improvement in broiler growth rate, however, has renewed interest in lighting programs as an aid in restricting early growth. The table (2.2) below shows the perfect lightning plan per hour for the broiler.

Table (2.2): Shows the scheduled lightning hours

Days	Light(hour)	Dark(hour)
0-3	24	0
4-7	18	6
8-14	14	10
15-21	16	8

- **Nutrition**

Poultry convert feed into food products quickly, efficiently, and with relatively low environmental impact compared with other livestock. The high rate of productivity of poultry results in relatively high nutrient needs. Providing the right nutrition is important for poultry growth, production and health. Different energy requirements are required, depending on factors including bird age and production status. Providing adequate nutrition is important so that the bird is able to achieve its productive potential and also for it to sustain health.Feed that is of poor quality, not in the right form or does not contain the right levels of energy and mix of nutrients, can potentially cause nutritional stress and lead to other health concerns.

- **Watering**

Water is not often thought of as a nutrient, but it is an important nutrient because it regulates body temperature, transports other nutrients, and takes part in numerous chemical reactions in the body. Therefore, water should be available to the birds at all times. Water consumption can be affected by feed type, stage of production and growth, disease status and environmental temperature. Birds can drink up to twice their estimated daily water consumption under hot environmental conditions.

- **Litter materials**

Broiler litter is the material used as bedding in poultry houses to absorb fiscal waste from birds and to make the floor of the house easy to manage. Common litter materials are wood shavings; chopped straw, sawdust, shredded paper and rice hulls, and a wide range of other materials are used in different regions around the world. Litter should be light, friable, non-compressible, absorbent, quick to dry, of low thermal conductivity and –very important – cheap. After use, the litter comprises poultry manure, the original litter material, feathers and spilled feed. The litter quality in a shed is determined by the type of diet, the temperature and the humidity. The recommended depth for litter is between 10 and 20 cm.

2.3.2 Previous Studies

There are many excellent studies that are working in the smart poultry industry and it would be helpful.

- Smart poultry farm: an integrated solution using WSN and GPRS based network

Rupali B. Mahaleethas discussed about the monitoring the poultry farm by using wireless sensor and general packet radio service **(**GPRS) based network. This system monitors the water, food level and surrounding environmental parameters of a poultry farm including temperature and humidity. Through this system the person in charge of poultry farm can get internal environment of a poultry farm at anytime and anywhere with the help of GPRS network[4].

- Smart farm using wireless sensor network

Vaibhavraj S. Rohamet describes about the Wireless sensor network to design the smart environment to monitor and control various climatic parameters. They were used the wireless sensor network in the greenhouses, where this network is connected to Beagle Bone Controller. Beagle Bone Controller is a device which will collect all the climatic parameters and dump into web server's database by regular time interval. Web application and Smartphone application will analyze the climatic parameter values and predict the preventive measures for the corresponding environmental conditions. System will be powered by solar and storage batteries[5].

- Internet based smart poultry farm

K. Sravanth Goudeth as elaborated the advanced technique of wireless sensor network and mobile network to control and automatically monitor the environmental parameters of poultry. Person can able to monitor environmental parameters by sending SMS back to the system. Parameters like temperature and humidity. If system does not receive command from registered mobile number, then it will automatically perform its action. Hence by using this modern technique system can provide a modern technique for farm automation[6].

-Incorporating smart sensing technologies into the poultry industry

Gerard Corkery discussed about using smart sensing technologies into the poultry industry to monitor critical environmental parameters which are relevant to poultry production include inter alia air temperature, relative humidity, light, air speed and air quality (in particular CO_2 and NH_3 concentrations). Current industry practice with regard to the measurement of these parameters in addition of the effect of these parameters on bird welfare is reviewed. Hence they reviewed about this smart sensing technology in the poultry industry[7].

-Design and implementation of smart relay based remote monitoring and controlling of ammonia in poultry houses

Jawad K. Othmanet Using smart relays in poultry farm which provides a lot of flexibility and reduction of cost for the design and implementation of monitoring and control systems through the functions they have compared with the classic equipment. The smart relay with communication interface have been used in this work in order to remotely monitor and control NH_3 concentration, RH, and temperature in the poultry houses by sending alert messages or receive instruction messages via SMS to or from the mobile phone of the supervisor[8].

- Smart farm monitoring using Raspberry Pi and Arduino

Siwakorn Jindarath as designed an intelligent system over the embedded system and smart phone for poultry management. To solve the problem author as used Raspberry Pi and Arduino Uno. This system should monitor the surrounding parameters of poultry environment including humidity, temperature, climate quality, the filter fan switches. This system is found very simple and useful for formers, as they can effectively control the poultry farm at any time and from anywhere[9].

CHAPTER THREE

NETWORK

3.1Introduction

When we communicate, we are sharing information. This sharing can be local or remotely. Between individuals, local communication usually occurs face to face, while remote communication takes place over distance. The term telecommunication, which includes telephony, telegraphy, and television, means communication at a distance (teleis Greek for "far").The word data refers to information presented in whatever form is agreed upon by the parties creating and using the data. Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable. For data communications to occur, the communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software (programs). The effectiveness of a data communications system depends on four fundamental characteristics: delivery, accuracy, timeliness, and jitter[10].

i. Delivery

   The system must deliver data to the correct destination. Data must be received by the intended device or user and only by that device or user.

ii. Accuracy

   The system must deliver the data accurately. Data that have been altered in transmission and left uncorrected are unusable.

iii. Timeliness

   The system must deliver data in a timely manner. Data delivered late are useless. In the case of video and audio, timely delivery means delivering data as they are produced, in the same order that they are produced, and without significant delay. This kind of delivery is called *real-time* transmission.

iv. Jitter

Jitter refers to the variation in the packet arrival time. It is the uneven delay in the delivery of audio or video packets. For example, let us assume that video packets are sent every 3D ms. if some of the packets arrive with 3D-ms delay and others with 4D-ms delay, an uneven quality in the video is the result.

- A data communications system has five components as shown in Figure 3.1[10].

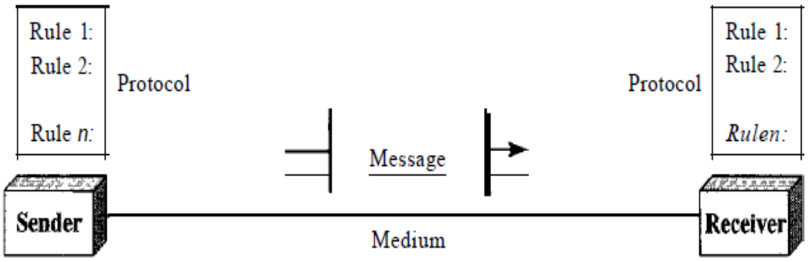

Figure 3.1:Five components of data communication.

i. Message

The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.

ii. Sender

The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.

iii. Receiver

The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.

iv. Transmission medium

The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves.

v. Protocol

A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating, just as a person speaking French cannot be understood by a person who speaks only Japanese.

Data Representation comes in different forms such as text, numbers, images, audio, and video. Data Flow Communication between two devices can be simplex, half-duplex, or full-duplex as shown in Figure 3.2[10].

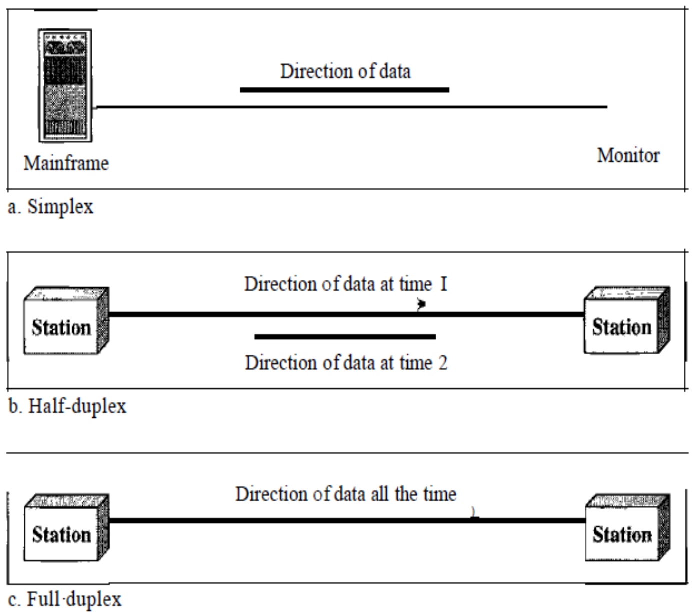

Figure 3.2: Data flow (simplex, half-duplex, and full-duplex)

- Simplex

In simplex mode, the communication is unidirectional, as on a one-way street. Only one of the two devices on a link can transmit; the other can only receive.

- Half-Duplex

  In half-duplex mode, each station can both transmit and receive, but not at the same time. When one device is sending, the other can only receive, and vice versa.
- Full-Duplex

  In full-duplex mode (also called duplex) both stations can transmit and receive simultaneously.

3.2 Networks in Production Field

A network is a set of devices (often referred to as nodes) connected by communication links. A node can be a computer, printer, sensors or any other device capable of sending and/or receiving data generated by other nodes on the network. More data originates from the operation of deployed sensors that have minimal human intervention than from user interfaces to equipment and peripheral devices such as keyboards. Using the communications infrastructure of the internet, widely distributed sensors and actuators form an electronic ecosystem known as the "internet of things". As technology and networks link more things, increasing volumes of information and improved data analysis is available for decision-making. Data monitoring of environments and infrastructure can also result in information to enhance situational awareness of weather, traffic and buildings. Long-range analytics can also be applied to historical sensor data to assist in planning, marketing and investment. In retail, historical data may be used to profile purchase choices and directly market similar products. In health care, long-term continuous monitoring may provide better diagnosis and subsequent treatment not otherwise identified. The automation and control category generally uses sensor data derived from a particular process and subsequent analysis in feedback loops to modify and improve that process. This can be as simple as water irrigation in response to soil moisture sensors. The key objective is process optimization, whether it is for quality, time and waste reduction, energy efficiency or human intervention. More complex autonomous systems involve real-time sensing of unpredictable conditions and require instantaneous autonomous responses. In production field it can connection and analysis data through sensing and monitoring. Sensors are parts of all machines that gather data and have an integral role in subsequent processing and transport of data. Monitoring is a process that observes a state in time or tracks changes in data sets to derive information. Together, sensing and monitoring provide a mechanism for harvesting digital data. This growth in digital data is being used to drive changes in production and distribution processes and the reach of services in the Australian economy. Sensor developments in miniaturization and the integration of sensors into intelligent devices and systems have increased the capacity to measure, analyze and aggregate data at a much localized level. Built on the increasing capabilities of fixed-access and wireless networks, smart sensor developments allow the collection of raw data, which is processed into information and conveyed via a network connection. Data processing capabilities have also been streamlined and automated through the use of data centers and pattern recognition processes that allow near real-time data mining and analysis. Using the infrastructure of the internet and machine-to-machine communications has allowed the connection of more devices and transfer of more information not directly controlled or monitored by humans. The exponential increase in the number of devices with digital connectivity will require new connection and management processes. Addressing and identifying a population of potentially tens of billions of devices requires reliable, scalable and flexible systems to work between industry entities and consumers. The combination of these technology developments means that information is now gathered from more human and machine-based sources, and analyzed and disseminated than ever before. Information harvesting through sensing and monitoring is increasingly pervasive in many aspects of day-to-day life and is being used to drive changes in life-supporting sectors such as food, health, energy, environment, and entertainment and social engagement. Identity management of millions of autonomous mobile sensor devices in a global environment presents challenges for sensor network operators and device life-cycle management. Dealing with smart junk, or the accumulation of lost or rogue devices without a traceable identity, is one of the challenges in managing the device and data growth. Trusted relationships between consumers and industry will need to be extended to devices in this environment. Data ownership, privacy, longevity of access and use are all potential issues in the provision of services to consumers in a smart digital economy. Advances in information and communications technology (ICT), including the digitization of information, means that more information is now gathered, disseminated, analyzed and stored than ever before. The growth of available information can provide valuable knowledge of the broader and immediate environments, and consequently the ability of individuals and businesses to exert control and influence over their environment. Technology developments in sensing and monitoring continue to drive process efficiencies, improvements in data quality and increased relevance of the derived information[11].

3.3 Steps in networking in production field

It consist of three primary steps, collecting data, connecting data and data mining and analysis [11].

3.3.1 Collecting data

Sensors are fundamental elements of all machines that gather data, require feedback for their operation or are required to provide a Human Machine Interface (HMI). Purpose-specific sensors that are observable by instruments have been developed to enhance the scope and range of measurements. Electronic sensors based on semiconductor devices have been integrated with computers and communications networks to provide useful informationgathering solutions. Technological developments in materials and electronics have led to the miniaturization and integration of sensors into intelligent devices and systems that not only measure and analyze but also act on the resultant information. Intelligent sensors can also consolidate observations, and aggregate and analyze data locally to conserve downstream communications and analysis resources. Today, autonomous and connected sensors are able to selectively sample and measure many physical properties such as temperature, force, pressure, flow, position, and light intensity without impacting on the properties being measured. Sensors are generally part of a more comprehensive monitoring or data acquisition system that conditions, processes, converts and transports data. Monitoring is a process that observes a state in time or tracks changes in states over time. Observations may be made by humans or sensor-based instruments to form data sets from which information can be derived. Monitoring is governed by sensor functionality and the data analysis requirements, effectively bridging the two processes of sensing and analysis. The application of monitoring plays an important role in collecting sufficient relevant information to achieve the desired outcomes of the process. Some monitoring systems are required to make observations from multiple remote and dispersed sensors that in turn require a single communications network path to transport individual sensor data to a point of aggregation and analysis. Where multiple sensors are concentrated over a smaller area, an underlying sensor–mesh network may be used to aggregate data prior to data transport over a communications network. The frequency and accuracy of sensor observations may also determine monitoring system design and particularly the proportion of resources that are sensor, communications and analysis based. Sensors can also be connected to actuators that translate information from the digital world into actions in the real world. For example, an integrated device may measure temperature, send digitized observations to a central point for analysis and receive information used to control a heater or cooler. This feedback process between sensors and actuators can be performed locally in a programmable device or remotely over a communications network. The integration of sensors, actuators, monitoring and analysis not only increases functionality but provides efficiencies in power consumption and physical footprint. Miniaturized intelligent sensors are used in an increasing amount of applications from a range of devices such as cameras, cellular handsets, medical imaging equipment, and video and audio devices, also Micro-electronic-mechanical (MEM) devices are emerging as integrated device solutions. MEMs differ from conventional microchips in that they have built-in mechanical functions that allow them to act as both sensors and actuators, and Mechanical actuators extend the functionality of sensors by enabling a response with force. For example, MEM devices are used in cameras to compensate for shake by adding a gyroscope and data conversion technology to prevent blurred photographic images. The manufacture and embedding of smaller sensors into products is becoming a high-growth industry. According to Data Beans Inc. Sensors and MEMS can be considered a high-growth industry and is expected to increase penetration in automobiles, computers, and most significantly, portable products such as media players, tablet PCs, and smart phone.

3.3.2Connecting data

Sensors require a network of interconnecting infrastructure to communicate and process the information required for services and monitoring applications. The availability of fixed-access and wireless mobile networks has guided the evolution of sensing by providing bidirectional connectivity for associated monitoring and control. Third-party integrators dominate systems development to provide novel and fragmented solutions across different industry sectors. These solutions tend to be dedicated, proprietary in nature and lacking interoperability. Wireless-based technologies such as Wi-Fi, ZigBee and 6LoWPAN are playing an increasing role at the sensor layer. Wi-Fi has gained wide acceptance in networks where power sourcing is not a major issue. ZigBee provides a suite of non-IP protocols, which are an implementation of the IEEE 802.15.4 standard for wireless personal area networks (WPAN) to provide communications with better speed response and lower power characteristics. The 6LoWPAN standard uses IPv6-based addressing over a low-power WPAN with limited power requirements. It is suited to wireless sensors applications where low power consumption and direct device addressing are desirable.

3.3.3 Data mining and analysis

The underlying strategic value of sensing and monitoring is in the information derived from the data acquisition, mining and the analysis processes. Over recent years, data processing has been simplified and streamlined through the use of data centers and high-speed cloud computing capabilities. Data analysis is now automated to the extent that pattern recognition processes are executed in near real-time. Intelligent applications can sense events, send data to a remote center for analysis and receive a response in the form of information to assist in a decision or initiate an action. Stream computing technology is emerging to provide real-time fast analysis of massive volumes of data to help with timely decision-making, before data is saved to databases. Multiple continuous streams of data may originate from sensors to be classified, filtered, correlated and transformed into informed decisions. Companies are developing systems and strategies to convert momentary data into linkable information. International Business Machines (IBM) Smarter Planet Program focuses on a new generation of smart products comprising services, devices and software to form an intelligent ecosystem or system of systems ‘architecture. Hewlett Packard has also developed their technology Central Nervous System for the Earth (CeNSE). The high-performance sensing technology consists of a trillion nano scale sensors and actuators embedded in the global environment and connected via an array of networks with computing systems, software and services to exchange their collective intelligence among analysis engines, storage systems and end-users.

3.4 Monitoring and Controlling in Production Field

Many aspects of daily life and information used for decision-making are already derived from data collected in various sectors of the digital economy. Everyday considerations like food, health, power production and consumption, the physical environment and human interactions are monitored using information collected, stored and analyzed through digital communications technologies. The food industry has widely adopted sensing and monitoring technologies in its production, processing, distribution and sales processes. Sensor networks play an important role in minimizing the risk of hazardous or poor quality food products being sold for human consumption. Sensors can be used to track, trace, and monitor products by employing transducers that measure immediate environmental aspects such as light, heat, moisture, location and time that are important to the quality management of perishable products. The Dutch VDL Agrotech Company (most advanced company in agricultural platform) had begun to use the sensor network and developed it to take place in several agricultural needs, it uses monitoring and remote control to adjust the perfect environment and stable system. In this project monitoring is done by a web page designed by PHP (Personal Home Page) language and the data is sent from the farm by using serial Wi-Fi. The web page monitor the data sent like temperature, humidity, motor status and the current week of the poultry [11].

3.5 Open System Interconnection (OSI Model)

The purpose of the OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software. The OSI model is not a protocol; it is a model for understanding and designing a network architecture that is flexible, robust, and interoperable. The OSI model is layered framework for the design of network systems that allows communication between all types of computer systems. It consists of seven separate but related layers, each of which defines a part of the process of moving information across a network. The OSI model is composed of seven ordered layers: physical (layer 1), data link (layer 2), network (layer 3), transport (layer 4), session (layer 5), and presentation (layer 6), and application (layer 7).The seven layers can be thought of as belonging to three subgroups. Layers I, 2, and 3-physical, data link, and network-are the network support layers; they deal with the physical aspects of moving data from one device to another (such as electrical specifications, physical connections, physical addressing, and transport timing and reliability). Layers 5, 6, and 7-session, presentation, and application-can be thought of as the user support layers; they allow interoperability among unrelated software systems. Layer 4, the transport layer, links the two subgroups and ensures that what the lower layers have transmitted is in a form that the upper layers can use [10].

3.6 TCP/IP Protocol Suite

The TCP/IP protocol suite was developed prior to the OSI model. Therefore, the layers in the TCP/IP protocol suite do not exactly match those in the OSI model. The original TCP/IP protocol suite was defined as having four layers: host-to-network, internet, transport, and application. However, when TCP/IP is compared to OSI, we can say that the host-to-network layer is equivalent to the combination of the physical and data link layers. The internet layer is equivalent to the network layer, and the application layer is roughly doing the job of the session, presentation, and application layers with the transport layer in TCP/IP taking care of part of the duties of the session layer.TCP/IP is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality; however, the modules are not necessarily interdependent. Whereas the OSI model specifies which functions belong to each of its layers, the layers of the TCP/I protocol suite contain relatively independent protocols that can be mixed and matched depending on the needs of the system. The term hierarchical means that each upper-level protocol is supported by one or more lower-level protocols. At the network layer, the main protocol defined by TCP/IP is the Internetworking Protocol (IP); there are also some other protocols that support data movement in this layer [10].

3.6.1 Internetworking protocol (IP)

The Internetworking Protocol (IP) is the transmission mechanism used by the TCP/IP protocols. It is an unreliable and connectionless protocol-a best-effort delivery service. The term best effort means that IP provides no error checking or tracking. IP assumes the unreliability of the underlying layers and does its best to get a transmission through to its destination, but with no guarantees. IP transports data in packets called data grams, each of which is transported separately. Datagrams can travel along different routes and can arrive out of sequence or be duplicated. IP does not keep track of the routes and has no facility for reordering datagrams once they arrive at their destination. The limited functionality of IP should not be considered a weakness, however. IP provides bare-bones transmission functions that free the user to add only those facilities necessary for a given application and thereby allows for maximum efficiency [10].

3.7 PHP

PHP is a Web development language written by and for Web developers. PHP stands for Hypertext Preprocessor. The product was originally named Personal Home Page Tools, and many people still think that's what the acronym stands for. The name was selected by community vote. PHP is currently in its fifth major rewrite, called PHP5 or just plain PHP.PHP is a server-side scripting language, which can be embedded in HTML (Hyper Text Markup Language) –the standard markup language for creating web pages- or used as a standalone programming language (although the former use is much more common).Comparable languages in this area are Microsoft's Active Server Pages, Macromedia's ColdFusion, and Sun's Java Server Pages. Normally PHP is used to generate XHTML (Extensible Hypertext Markup Language)[12].

3.7.1Historyof PHP

Rasmus Lerdorfa software engineer and Apache team member is the creator and original driving force behind PHP. The first part of PHP was developed for his personal use in late 1994. This was a CGI wrapper that helped him keep track of people who looked at his personal site. The next year, he put together a package called the Personal Home Page Tools (a.k.a. The PHP Construction Kit) in response to demand from users who had stumbled into his work by chance or word of mouth. Version 2 was soon released under the title PHP/FI and included the Form Interpreter, a tool for parsing SQL queries. By the middle of 1997, PHP was being used on approximately 50,000 sites worldwide. It was clearly becoming too big for any single person to handle, even someone as focused and energetic as Rasmus. A small core development team now runs the project on the open source "benevolent junta" model, with contributions from developers and users around the world. Zeev Suraski and Andi Gutmans, the two Israeli programmers who developed the PHP3 and PHP4 parsers, have also generalized and extended their work under the rubric of Zend.com. The fourth quarter of 1998 initiated a period of explosive growth for PHP, as all open source technologies enjoyed massive publicity. In October 1998, according to the best guess, just over 100,000 unique domains used PHP in some way. Just over a year later, PHP broke the one-million domain mark. Public PHP deployments run the gamut from mass-market sites such as Excite Webmail and the Indianapolis 500 Web site, which serve up millions of page views per day, through sites such as Sourceforge.net and Epinions.com, which tend to have higher functionality needs and hundreds of thousands of users, to e-commerce and brochure ware sites such as The Bookstore atHarvard.com and Sade.com (Web home of the British singer), which must be visually attractive and easy to update. There are also PHP-enabled parts of sites, such as the forums on the Internet Movie Database (imdb.com); and a large installed base of nonpublic PHP deployments, such as LDAP directories (MCI WorldCom built one with over 100,000 entries) and trouble-ticket tracking systems.PHP5's newly rebuilt object model brings PHP more in line with other object-oriented languages such as Java and C++, offering support for features such as overloading, interfaces, private member variables and methods, and other standard OOP constructions[12].

3.7.2 Advantages of PHP

i. It costs you nothing

   The Apache/PHP/MySQL combo runs great on cheap, low-end hardware that you couldn't even think about for IIS/ASP/SQL Server.

ii. Open source software

   The program as a whole is released under its own PHP license on the model of the BSD license (Zend as a standalone product is released under the Q Public License -this clause applies only if you unbundle Zend from PHP and try to sell it).

iii. Ease of Use

   PHP is easy to learn, compared to the other ways to achieve similar functionality. Unlike Java Server Pages or C-based CGI, PHP doesn't require you to gain a deep understanding of a major programming language before you can make a trivial database or remote-server call.

iv. Cross-platform compatibility

PHP run native on every popular flavor of UNIX (including Mac OS X) and Windows.

v. Stability

The server doesn't need to be rebooted often. The software doesn't change radically and incompatibly from release to release.

vi. Speed

PHP is fast in its execution, especially when compiled as an Apache module on the UNIX side.

CHAPTER FOUR

PROTOTYPE DESIGN AND IMPLEMENTATION

4.1 Poultry Systems

The following systems are the main systems in the poultry to control the environment and the feeding.

4.1.1 Nutrition system

It is a system aims to provide food for poultry farm and distributed on a regular basis, in a pan was allocated for this function.

4.1.2 Lighting system

It is a system to provide light ideally, without needing to lock and unlock the switches.

4.1.3 Ventilation system

Ventilation is the exchange of air in a building with fresh air from outside and exhausted moisture, noxious gases, dust and microorganisms. Ventilation systems are designed to maintain air quality during cold weather and to regulate temperature during hot weather.

4.1.4 Cooling and heating system

It is a system used to adjust the temperature of a poultry farm in the desired degree, according to the change in the temperature of the surrounding environment.

4.1.5 Water level system

Is used to indicate the level of water in overhead tank, by using LED.

4.1.6 Alert system:

It is a system work when a physical parameter crosses a predefined value.

4.1.7 Monitoring system:

It is a system designed to monitor the level of water at tank, temperature and humidity.

4.2 Block Diagram and Circuit

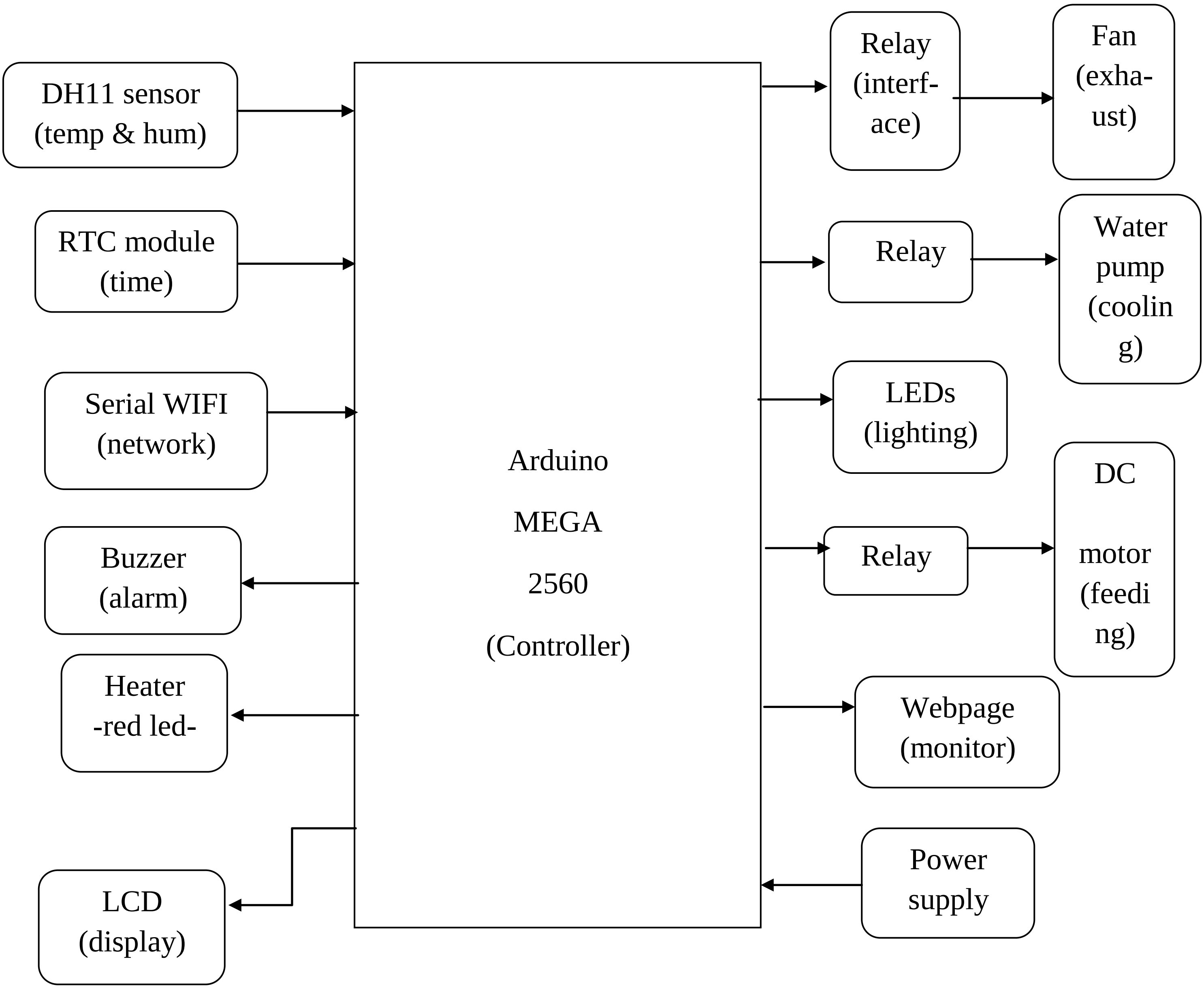

Figure 4.1 shows the hardware block diagram of the design.

4.3 System Components

The components of the system can be divided into physical components (hardware) and integral components (software).

4.3.1 Hardware components

- **The Arduino mega 2560**

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs -hardware serial ports-, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino.

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may over heat and damage the board. The recommended range is 7 to 12 volts. Power pins are as follows:

-VIN: The input voltage to the Arduino board when it's using an external power source.

- **5V:** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

- **3V3:** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

- **GND:** Ground pins.

- **Input / Output pins**

Each of the 54 digital pins on the Mega can be used as an input or output, using **pinMode(),digitalWrite(),**and**digitalRead()**functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and14 (TX).Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the Corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .

-External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21(interrupt2).These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

-PWM: 0 to 13. Provide 8-bit PWM output with the **analogWrite()**function.

-LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Mega2560 has 16 analog inputs, each of which provides 10 bits of resolution, 1024 different values. By default they measure from ground to 5 volts. The following figure (4.2) shows the Arduino mega

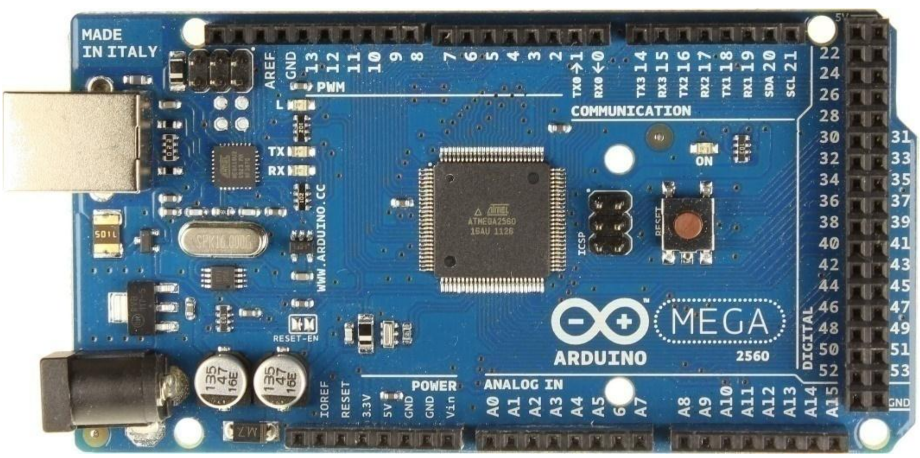

Figure (4.2): Shows the Arduino mega

- **Specification:**

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by boot loader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

- **DHT11 humidity and temperature sensor**

DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and NTC temperature measurement devices. Figure (4.2) shows the DHT11 sensor.

Features

Low cost, long-term stability, relative humidity and temperature measurement, excellent quality, fast response, strong anti-interference ability, long distance signal transmission, digital signal output, and precise calibration.

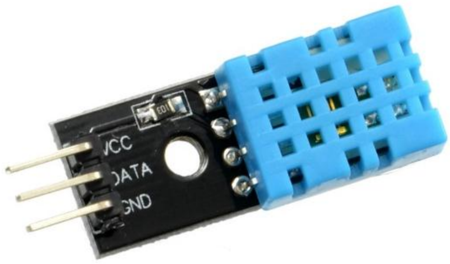

Figure (4.3): Shows DHT11 sensor

Specifications:

Relative humidity

Resolution: 16Bit

Repeatability: ±1% RH

Accuracy: At 25℃ ±5% RH

Interchangeability: fully interchangeable

Response time: 1 / e (63%) of 25℃ 6s

1m / s air 6s

Hysteresis: <± 0.3% RH

Long-term stability: <± 0.5% RH / yr in

Temperature

Resolution: 16Bit

Repeatability: ±0.2℃

Range: At 25℃ ±2℃

Response time: 1 / e (63%) 10S

Electrical Characteristics

Power supply: DC 3.5～5.5V

- **DC motor**

A motor is an electrical machine that converts electrical energy into mechanical energy. The working principal is based on the theory that when a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force whose direction is giving by Fleming’s left- hand rule.

- **Buzzer**

Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, telephones, timers and other electronic products for sound devices, buzzer can be controlled with single-ship microcontroller IO directly and it works at 5V.

- **Power supply**

All electronic circuits need power supply to operate. Different circuits need difference value of voltage which provides by power supply.

The wires on the main 24 pin connectors are color coded. These are the same for all power supplies:

3.3V wires are orange.

+5V wires are red.

-5V wires (if they are present) are white.

+12V wires are yellow.

-12V wires are blue.

Ground wires are black.

- **Light Emitting Diode**

A Light Emitting Diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for lighting. When a LED is forward-biased (switched on), electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of light is determined by the energy gap of the semiconductor. LEDs are often small in area, and integrated optical components may be used to shape its radiation pattern.

- **Exhaust Fan**

Exhaust fan is a mechanical ventilation device use to supply the energy needed to exchange the desired amount of air in a poultry house each minute.

- **Relay module**

A relay is an electrical switch that uses an electromagnet to move the switch from the off to one position. It has a control system called input contactor and controlled system called output contactor. It is an automatic switch to controlling a high-current circuit with a low-current signal.

- **LCD screen**

LCD display characters such as text and numbers are the most inexpensive and simplest to use of all LCDs. They can be purchased in various sizes, which are measured by the number of rows and columns of characters they can display. A 16*2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable, have no limitation of displaying special and even custom characters unlike in seven segments.

16*2LCD mean it can display 16 characters per line and there such lines. It has 16 pins and the first one from left to right is the Ground pin. The second pin is the VCC which connect to the 5 volts pin on the Arduino Board. Next is the Vo pin on which can attach a potentiometer for controlling the contrast of the display. Next, The RS pin or register select pin is used for selecting whether send commands or data to the LCD. Next comes the R / W pin which selects the mode whether we will read or write to the LCD. Next is the E pin which enables the writing to the registers, the next 8 data pins from D0 to D7. So through this pins we are sending the 8 bits data when we are writing to the registers. And the last two pins A and K, or anode and cathode are for the LED back light.

- **Pump**

A water pump is any device for moving water. The water pump is one of the oldest and most widespread machines, and exists in an enormous variety of styles.

- **The ESP8266 Wi-Fi module**

The ESP8266 Wi-Fi Module is a self-contained system on chip (SOC) with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices. Figure (4.3) shows the Wi-Fi module.

Figure (4.4): Shows the ESP8266 Wi-Fi module

- **Real time clock (RTC) module**

A real time clock is basically just like a watch - it runs on a battery and keeps time for you even when there is a power outage! Using an RTC, you can keep track of long timelines, even if you reprogram your microcontroller or disconnect it from USB or a power plug. While this sort of basic timekeeping is OK for some projects, some projects such as data-loggers, clocks, etc. it will need to have consistent timekeeping that doesn't reset when the Arduino battery dies or is reprogrammed. Thus, we include a separate RTC! The RTC chip is a specialized chip that just keeps track of time. It can count leap-years and knows how many days are in a month, but it doesn't take care of Daylight Savings Time (because it changes from place to place). Figure (4.4) shows the RTC module.

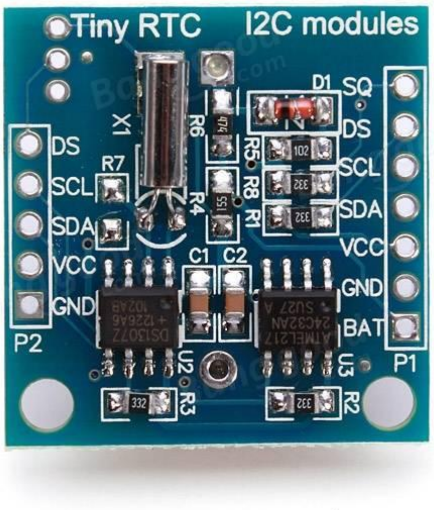

Figure (4.5): RTC module

4.3.2 Software Components

- **Arduino Software**

To make Arduino do some useful work, it’s needed to give it instructions. Software programs called sketches are created on computer using the Arduino Integrated Development Environment (IDE). The IDE enables to wire and edit code and convert this code into instructions that Arduino hardware understands. The IDE also transfers those instructions to the Arduino board (a process called uploading). The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop:

- Setup (): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.
- Loop (): After setup () has been called, function loop () is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

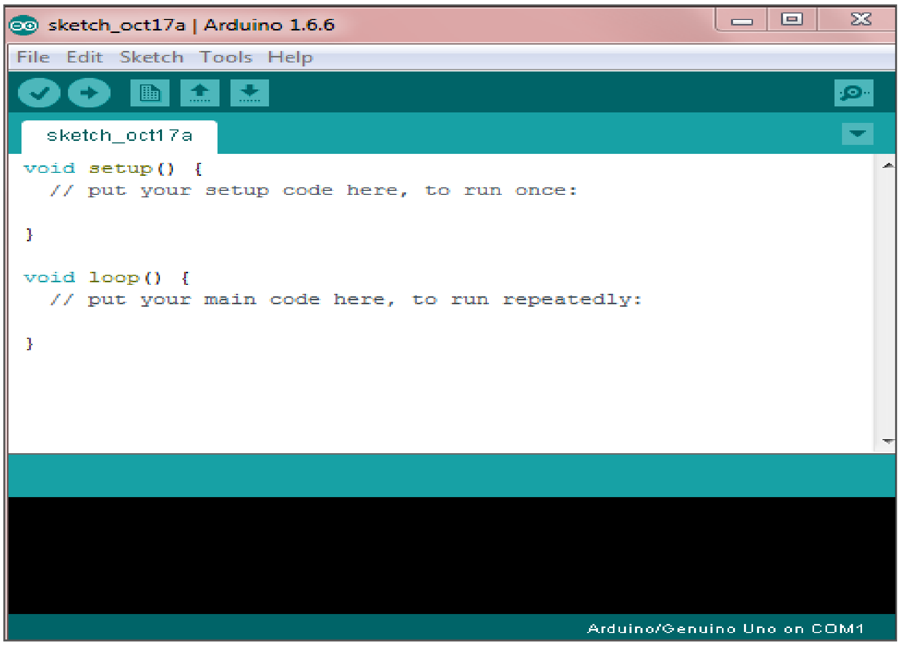

Figure (4.6): Arduino IDE

- **Network software**

The network webpage had been designed by using the PHP language, with the aid of the note++ (program for writing codes with different languages) the webpage code had been created and the webpage address was designed by using the webhost (website that creates free webpage addresses).

4.4 System Operations

4.4.1 Ventilation

Because of the indoor housing farm ventilation done to ensure an adequate supply of oxygen, while removing carbon dioxide, ammonia, other waste gases and dust. Ventilation done by exhaust fan, the fan had been connected directly to the power supply to work all the time to change the air continuously.

4.4.2 Cooling

High temperatures and humidity have negative affect on the food consumption, growth, activity of chickens and consequently the health. And because the broilers are very sensitive birds to the surrounded atmosphere the required temperatures and humidity is different from week to week, the temperature of the incubation tray is maintained in particular level. That is 25°C to 33°C. If the level is exceeds or below the prescribed level then the micro controller will turn on the cooler or heater function. The cooling process done by the fan and water pump which is used to pump water to the cooling pad to reduce the temperature, which is read by the temperature and humiditysensorDHT11. The Arduino IDE required temperatures and humidity for every week was entered, when the temperature rise within the systemDHT11 sensor give the Arduino signal, which is turn on a fan and the water pump to the cooling pad to be successfully cooling process. When the humidity is high DHT11 sensor give the Arduino signal, which is turn off the water pump.TheDHT11 sensor had been connected with digital pin in the Arduino as input device. The water pump and fan were connected to the digital pin as output on the Arduino through the relay which control the work of the pump and fan by change the position of contact.

4.4.3 Heating

In the winter the inner atmosphere is cold to ensure that the birds kept warm heater were used. When the temperature is reduced, the DHT11 will give the Arduino signal to turn on the red LED (works as heater), when the atmosphere return to normal condition the heater is turned off. The red LED had been connected to digital pin as output device on the Arduino.

4.4.4 Nutrition

The broiler are meat birds for that the pan feeder should be contained with food all the time, high quality food, fresh and nutritious always to ensure good health, proper growth and high production. The system had been done by the DC motor and RTC module, so food should not get waste and man power has reduced, the RTC adjusted to give the Arduino signal every hour to work the motor for a minute then the auger conveyor worked to push the food. The RTC module was connected to the digital pin in the Arduino as input device and the DC motor connected to the digital pin as output on the Arduino through the relay.

4.4.5 Lighting

The number of hours of day length and color of lamp had an important impact on growth rate and effect were dependent on age, so depending on the lighting program and orange LEDs the process was done. The system had been done by LEDs and RTC module, by adding the light hours in the day in the IDE the RTC gave the Arduino signal to turn on the LEDs otherwise the LEDs will turn off. LEDs were connected in parallel with a resistors to limit the flow of electrical current in the circuit, The RTC module was connected to analog pin as input and LEDs to digital pin as output on the Arduino.

4.4.6 Alert

Alert was used to alarm the farmer when a critical temperature has been reached in the farm. The process had been done by the buzzer, the DHT11sensor give the Arduino signal to turn on the buzzer when it rises above 40C°.The buzzer had been connected to digital pin as output on the Arduino.

4.4.7 Water level indicator

The water level indicator was done by using LEDs, the water level indicator for water tank is based upon the number of LEDs that glow to indicate the corresponding level of water, three LEDs in order are used; red, green and yellow LEDs were used to indicated the high, medium and low level in water tank. When the water reached the top of tank, the three LEDS are on, when the water reaches the medium the red LED is off and the other two are on, when the water level is lower than the medium only the yellow LED is on, and when the tank is empty the three LEDs are off.

4.4.8 Monitoring

This system should monitor the surrounding parameters of poultry environment including humidity, temperature, and the age (week) for a complete care of chicken it is important to monitor the environment of poultry; for the better growth of chickens. The monitoring had been done by two methods, by putting the LCD in the farm and by webpage so the person in-charge can able to monitor the farm in any time and any place by pc.

- **Monitoring by LCD**

The LCD screen was used to display the set and current temperature, humidity and week of the poultry by receiving read from the DHT11 sensor and RTC module.6 digital input pins from the Arduino Board had been used for this process. The LCD’s registers from D4 to D7, RS and The Enable had been connected to Arduino’s digital pins to send data by it. The R/W pin had been connected to Ground and the Vo pin had been connected to the potentiometer. Potentiometer had been used to adjust the brightness of the LCD, sometimes light is high so it can't be read on the LCD. So potentiometer is helpful for such conditions.

- **Monitoring by the webpage**

The main purpose of this system model is to make it easy for the user to view the current farm temperature, humidity, condition of DC motor on or off and the age by remote access, a webpage can be accessed anywhere and anytime through the Internet, thus saving human expenses, the system had been done by the Arduino and serial WIFI module esp8266. The page is designed as shown in figure (4.7)

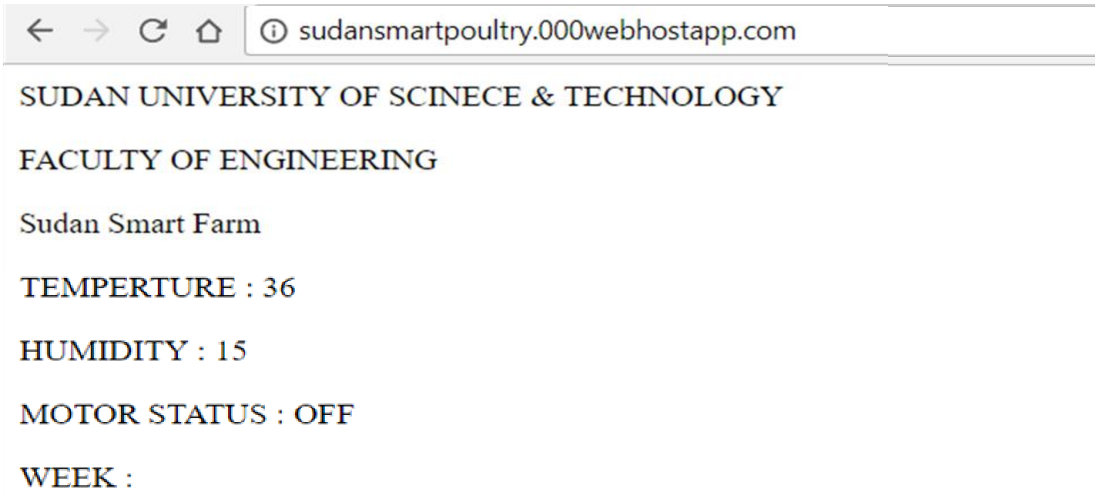

Figure (4.7): Monitoring Webpage

4.5 Testing and Results

Several testing procedures were conducted to evaluate the accuracy designed prototype. Different factors that might affect the design's performance were considered to prove its reliability in controlling and monitoring the temperature and humidity of the poultry, respectively.

4.5.1Verifying work of cooling and heater control

This test was done to ensure whether the design can actually measure the temperature of the poultry and could control it by using cooler and heater. The result of the test was shown in Table 4.1

Table 4.1: Verifying temperature control for three weeks

Time	Temperature	Fan and Cooler	Heater
Week 1	20<Temp<33	Off	off
	Temp>33	On	off
	Temp<20	Off	on
Week 2	20<Temp<28	Off	off
	Temp>28	On	off
	Temp<20	Off	on
Week 3	20<Temp<25	Off	off
	Temp>25	On	off
	Temp<20	off	on

Based from the results, all the temperature results specified were correctly verified by the system.

4.5.2 Alert system test

This test was used to ensure that the buzzer was working when temperature rise over 40 °C.

Table4.2: The test of alert system

Temperature(°C)	Buzzer
Temp>40°C	on
Temp<40°C	off

Based from the result, the buzzer was worked correctly.

4.5.3 Monitor system test

This test was used to ensure that the data displayed in the LCD is the same data displayed in the webpage.

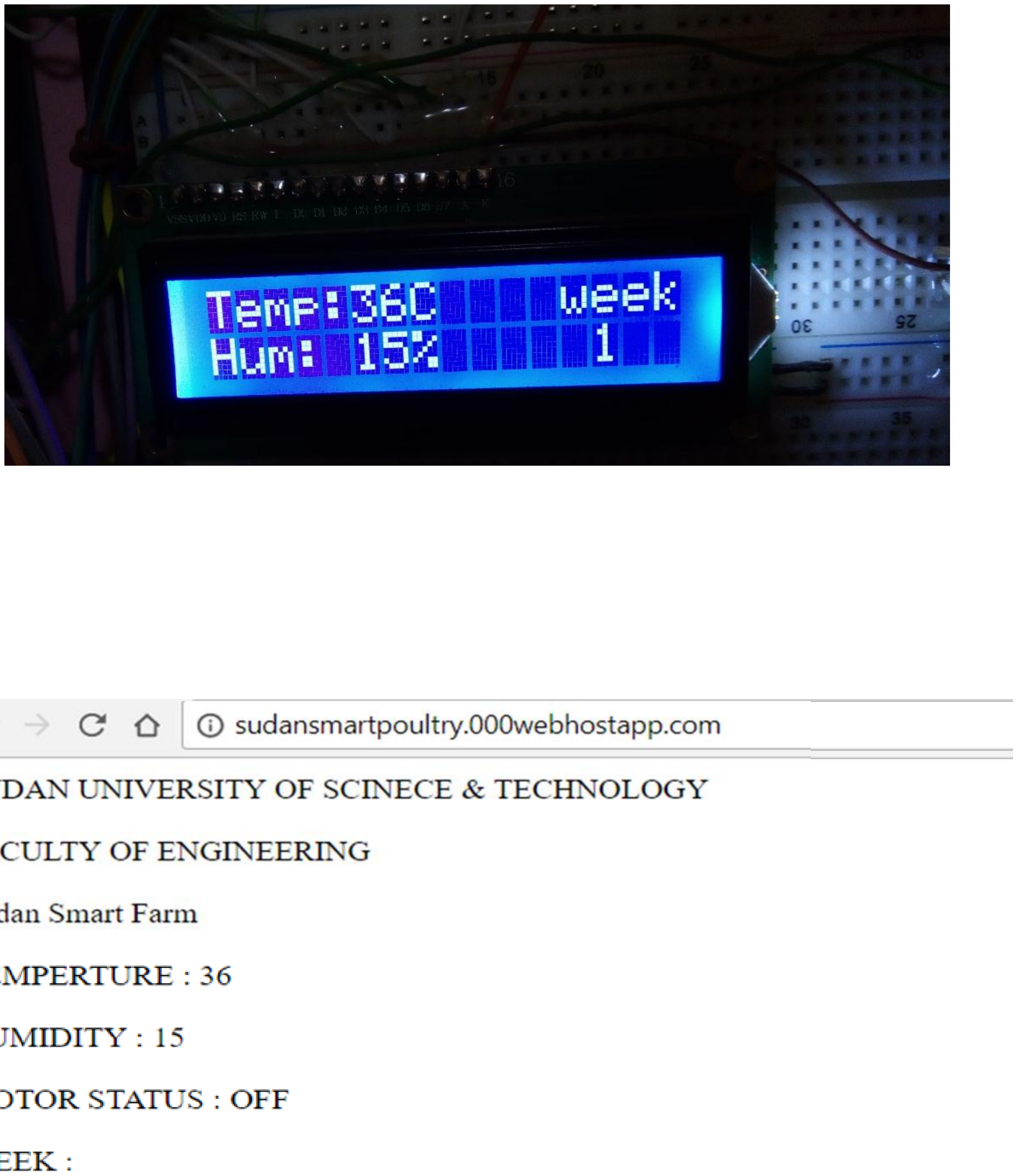

Figure (4.8): Monitoring Test

As shown in figure (4.8) the data on the LCD is the same data on the webpage.

4.6 Simulation Circuit

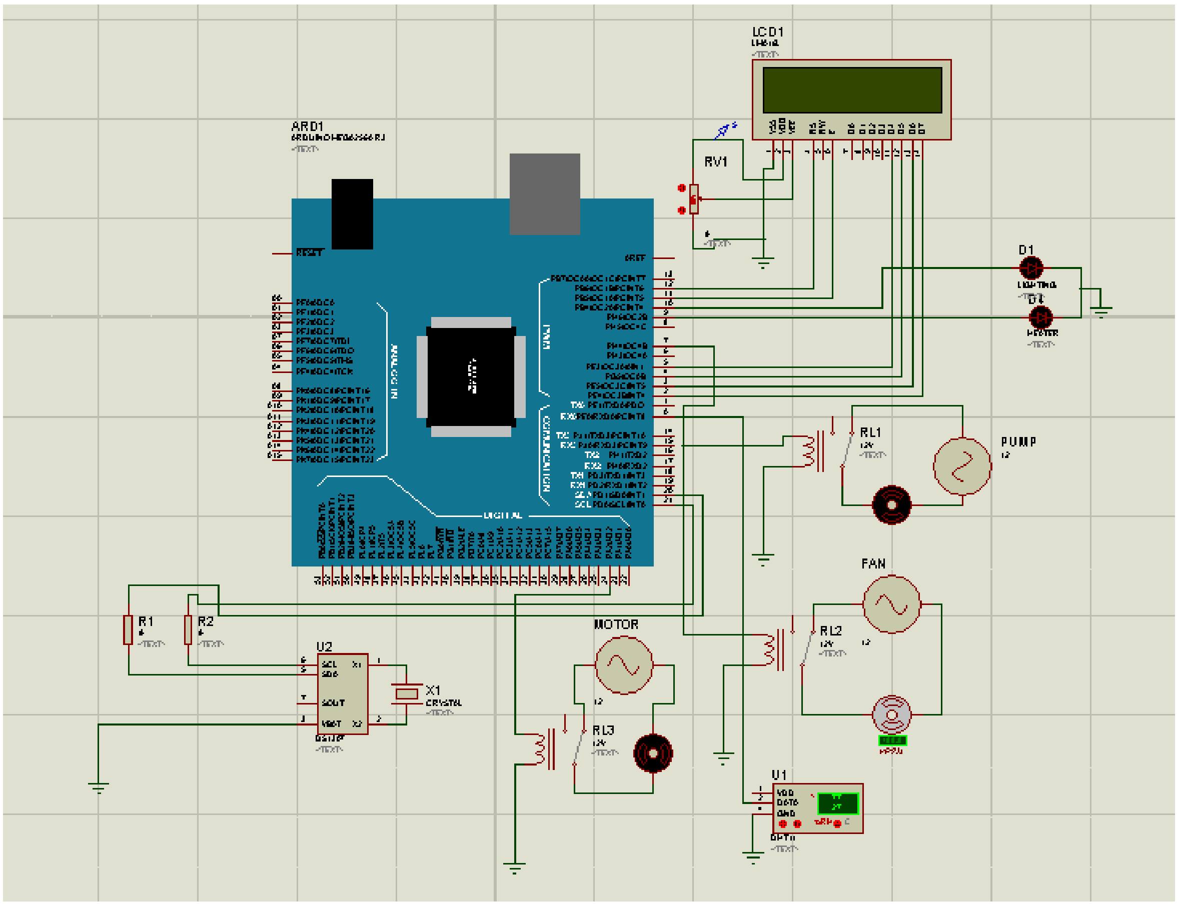

Figure (4.9): Simulation Circuit

CHAPTER FIVE

CONCLUSION AND RECOMENDATIONS

5.1 Conclusion

Automation is an innovative technology for poultry farming which can changes the traditional farm into modern automated poultry farm. The model had been designed and tested, and the webpage as well, various environmental parameters like temperature and humidity had been continuously monitored, and controlled to improve health and growth of the chickens. Feeding control mechanism helps to provide time to time food supply to the chickens as well as help to avoid the wastage of food. The network system helps the farmer to monitor the internal environment of poultry farm. Hence owner can be able to get all details of the poultry at anytime and anywhere.

5.2 Recommendations

To achieve desired goals the following steps may be recommended:

- Control the feeding not only by timing but also by weight sensor.
- A full network monitoring for all parameters.
- A full network control by applying the internet of things (IOT) to this project.

REFRENCES

[1] F. Golnaraghi and B. Kuo, "Automatic control systems," Complex Variables, vol. 2, pp. 1-1, 2010.

[2] P. Paraskevopoulos, Modern control engineering. CRC Press, 2001.

[3] M. Evans, J. J. Noble, and J. Hochenbaum, Arduino in action. Manning, 2013.

[4] R. B. Mahale and D. S. Sonavane, "Smart Poultry Farm: An Integrated Solution Using WSN and GPRS Based Network," International Journal of Advanced Research in Computer Engineering & Technology, vol. 5, no. 6, 2016.

[5] V. S. Roham, G. A. Pawar, A. S. Patil, and P. R. Rupnar, "Smart Farm using Wireless Sensor Network."

[6] K. S. Goud and A. Sudharson, "Internet based Smart Poultry Farm," Indian Journal of Science and Technology, vol. 8, no. 19, 2015.

[7] G. Corkery, S. Ward, C. Kenny, and P. Hemmingway, "Incorporating smart sensing technologies into the poultry industry," Journal of World's Poultry Research, vol. 3, no. 4, pp. 106-128, 2013.

[8] J. K. Othman and J. R. Mahmood, "Design and Implementation of Smart Relay based Remote Monitoring and Controlling of Ammonia in Poultry Houses," International Journal of Computer Applications, vol. 103, no. 8, 2014.

[9] S. Jindarat and P. Wuttidittachotti, "Smart farm monitoring using raspberry pi and arduino," in Computer, Communications, and Control Technology (I4CT), 2015 International Conference on, 2015, pp. 284-288: IEEE.

[10] A. B. Forouzan, Data communications & networking (sie). Tata McGraw-Hill Education, 2006.

[11] "Sensing and Monitoring," Australian Communication and media Authority, 2011.

[12] A. Giurca, "Introduction to PHP," 2005.

APPENDIX A

Program Code

```
#include <LiquidCrystal.h>

// initialize the library with the numbers of the interface pins

LiquidCrystallcd( 9, 10, 11, 12, 13, 6);

#include <idDHT11.h>

#include <Wire.h>

#include<EEPROM.h>

#include <RTClib.h>

RTC_DS1307 RTC;

inttmp, Inc, hor, mIn, add = 11;

int set = 30;

intcge = 31;

int mod = 32;

int off = 0;

#define buz 11

intHor, Min, Sec;

int r = 7;

int led = 8;

int idDHT11pin = 2; //Digital pin for comunications

int idDHT11intNumber = 0; //interrupt number (must be the one that use the
previus defined pin (see table above)

int x;

int y;

String ssid = "wifi";
```

```
String password = "12345678";
String data;
String server =  "mohdgamal620.000webhostapp.com"; // www.example.com
String url = "/update1.php";// our example is /esppost.php
String humidity, tempreture, motor;
String hum, temp, M;
String on = "on";
String off = "off";
//declaration
void dht11_wrapper(); // must be declared before the lib initialization
// Lib instantiate
idDHT11 DHT11(idDHT11pin, idDHT11intNumber, dht11_wrapper);
void setup()
{
Serial.begin(115200);
Serial1.begin(115200);
pinMode(led, OUTPUT);
pinMode(r, OUTPUT);
Wire.begin();
RTC.begin();
pinMode(cge, INPUT);
pinMode(set, INPUT);
pinMode(mod, INPUT);
pinMode(buz, OUTPUT);
pinMode(22, OUTPUT);
```

```
pinMode(23, OUTPUT);
digitalWrite(set, HIGH);
digitalWrite(mod, HIGH);
digitalWrite(cge, HIGH);
digitalWrite(led, HIGH);
lcd.begin(16, 2);
  // Print a message to the LCD.
lcd.print("Al-Qaris Farm");
delay(1000);
lcd.clear();
if (!RTC.isrunning())
  {
RTC.adjust(DateTime(__DATE__, __TIME__));
  }
reset();
connectWifi();
}
// This wrapper is in charge of calling
// mus be defined like this for the lib work
void dht11_wrapper() {
DHT11.isrCallback();
}
void reset() {
Serial1.begin(115200);
Serial1.println("AT+RST");
```

```
delay(1000);
if (Serial1.find("OK") ) {
Serial.println("Module Reset");
  }
}
//connect to your wifi network
voidconnectWifi() {
  String cmd = "AT+CWJAP=\"" + ssid + "\",\"" + password + "\"";
Serial1.println(cmd);
delay(4000);
if (Serial1.find("OK")) {
Serial.println("Connected!");
  }
else {
connectWifi();
Serial.println(" connect to wifi");
  }
}
voidhttppost () {
Serial1.begin(115200);
Serial1.println("AT+CIPSTART=\"TCP\",\"" + server + "\",80");//start a TCP connection.
if ( Serial1.find("OK")) {
Serial.println("TCP connection ready");
  }
  String postRequest =
```

```
    "POST " + url + " HTTP/1.0\r\n" +
    "Host: " + server + "\r\n" +
    "Accept: *" + "/" + "*\r\n" +
    "Content-Length: " + data.length() + "\r\n" +
    "Content-Type: application/x-www-form-urlencoded\r\n" +
    "\r\n" + data;
  String sendCmd = "AT+CIPSEND=";//determine the number of caracters to be sent.
Serial1.print(sendCmd);
Serial1.println(postRequest.length() );
if (Serial1.find(">")) {
Serial.println("Sending.."); Serial1.print(postRequest);
if ( Serial1.find("SEND OK")) {
Serial.println("Packet sent");
while (Serial1.available()) {
        String tmpResp = Serial1.readString();
Serial.println(tmpResp);
      }
      // close the connection
Serial1.println("AT+CIPCLOSE");
    }
  }
}
void loop()
{
DateTime now = RTC.now();
```

```
if (digitalRead(mod) == 0)
  {
current();
time();
delay(1000);
  }
Hor = now.hour(), DEC;
if (Hor<= 9)
  {
Serial.print("0");
Serial.print(Hor = now.hour(), DEC);
  }
else
Serial.print(Hor = now.hour(), DEC);
Serial.print(":");
  Min = now.minute(), DEC;
if (Min <= 9)
  {
Serial.print("0");
Serial.print(Min = now.minute(), DEC);
  }
else
Serial.print(Min = now.minute(), DEC);
Serial.print(":");
  Sec = now.second(), DEC;
```

```
if (Sec <= 9)
  {
Serial.print("0");
Serial.print(Sec = now.second(), DEC);
  }
else
Serial.print(Sec = now.second(), DEC);
Serial.print("Date: ");
Serial.print(now.day(), DEC);
Serial.print("/");
Serial.print(now.month(), DEC);
Serial.print("/");
Serial.println(now.year(), DEC);
delay(200);
Serial.print("\nRetrieving information from sensor: ");
Serial.print("Read sensor: ");
  //delay(100);
DHT11.acquire();
while (DHT11.acquiring())
    ;
int result = DHT11.getStatus();
switch (result)
  {
case IDDHTLIB_OK:
Serial.println("OK");
```

```
break;
case IDDHTLIB_ERROR_CHECKSUM:
Serial.println("Error\n\r\tChecksum error");
break;
case IDDHTLIB_ERROR_ISR_TIMEOUT:
Serial.println("Error\n\r\tISR Time out error");
break;
case IDDHTLIB_ERROR_RSerial1ONSE_TIMEOUT:
Serial.println("Error\n\r\tResponse time out error");
break;
case IDDHTLIB_ERROR_DATA_TIMEOUT:
Serial.println("Error\n\r\tData time out error");
break;
case IDDHTLIB_ERROR_ACQUIRING:
Serial.println("Error\n\r\tAcquiring");
break;
case IDDHTLIB_ERROR_DELTA:
Serial.println("Error\n\r\tDelta time to small");
break;
case IDDHTLIB_ERROR_NOTSTARTED:
Serial.println("Error\n\r\tNot started");
break;
default:
Serial.println("Unknown error");
break;
```

```
  }
Serial.print("Humidity (%): ");
Serial.println(DHT11.getHumidity(), 2);
Serial.print("Temperature (oC): ");
Serial.println(DHT11.getCelsius(), 2);
int z = (millis() / 1000);
  /////////////////////
Serial.println(z);
if ( DHT11.getCelsius() > 40)
  {
digitalWrite(buz, HIGH);
  }
else {
digitalWrite(buz, LOW);
  }
if ( DHT11.getCelsius() < 20)
  {
digitalWrite(23, HIGH);
  }
else {
digitalWrite(23, LOW);
  }
  /////////week 1 //////////////
if (z < 60) {
digitalWrite(led, HIGH);
```

```
Serial.println("first week");
lcd.setCursor(12, 0);
lcd.print("week");
lcd.setCursor(13, 1);
lcd.print("1");
int x = DHT11.getCelsius();
int y = DHT11.getHumidity();
if (y > 70) {
digitalWrite(r, LOW);
    }
else {
if (x > 33) {
digitalWrite(r, HIGH);
      }
else {
digitalWrite(r, LOW);
      }
delay(2000);
    }
Check();
  }
  /////////week 2////////
else if (z > 60 && z < 120) {
Check();
Serial.println("second week");
```

```
lcd.setCursor(12, 0);
lcd.print("week");
lcd.setCursor(13, 1);
lcd.print("2");
int x = DHT11.getCelsius();
int y = DHT11.getHumidity();
if (y > 75) {
digitalWrite(r, LOW);
    }
else {
if (x > 28) {
digitalWrite(r, HIGH);
      }
else {
digitalWrite(r, LOW);
      }
delay(2000);
    }
if (z > 100 && z < 120) {
digitalWrite(led, LOW);
    }
  }
  /////////// week 3,,,,,,,,,,,,,,
else if (z >= 120) {
digitalWrite(led, HIGH);
```

```
if (z > 150) {
digitalWrite(led, LOW);
  }
Check();
Serial.println("THIRD week");
lcd.setCursor(12, 0);
lcd.print("week");
lcd.setCursor(13, 1);
lcd.print("3");
int x = DHT11.getCelsius();
int y = DHT11.getHumidity();
if (y > 75) {
digitalWrite(r, LOW);
  }
else {
if (x > 25) {
digitalWrite(r, HIGH);
    }
else {
digitalWrite(r, LOW);
    }
delay(2000);
  }
if (z > 100) {
digitalWrite(led, LOW);
```

```
    }
  }
lcd.setCursor(0, 0);
lcd.print("Temp:");
lcd.print(DHT11.getCelsius());
lcd.print("C");
lcd.setCursor(0, 1);
lcd.print("Hum: ");
lcd.print(DHT11.getHumidity());
lcd.print("%");
  ///////////////////////////////
hum = DHT11.getHumidity();
temp = DHT11.getCelsius();
data = "clientID=Sheep1&humidity=" + String(hum)
         + "&tempreture=" + String(temp) + "&motor=" + String(M);
httppost();
}
void time()
{
inttmp = 1, mins = 0, hors = 0, secs = 0;
while (tmp == 1)
  {
off = 0;
if (digitalRead(cge) == 0)
    {
```

```
Hor++;
if (Hor == 24)
      {
Hor = 0;
      }
    }
Serial.println("Set Alarm Time ");
if (Hor<= 9)
Serial.print("0");
Serial.print(Hor);
Serial.print(": ");
Serial.print(Min);
Serial.print(": ");
Serial.print(Sec);
delay(300);
Serial.print(" ");
Serial.print(": ");
Serial.print(Min);
Serial.print(": ");
Serial.print(Sec);
delay(300);
if (digitalRead(set) == 0)
    {
hor = Hor;
EEPROM.write(add++, hor);
```

```
tmp = 2;
while (digitalRead(set) == 0);
    }
  }
while (tmp == 2)
  {
if (digitalRead(cge) == 0)
    {
      Min++;
if (Min == 60)
      {
        Min = 0;
      }
    }
Serial.print(Hor);
Serial.print(": ");
if (Min <= 9)
Serial.print("0");
Serial.print(Min);
Serial.print(": ");
Serial.print(Sec);
Serial.print(" ");
delay(300);
Serial.print(Hor);
Serial.print(": ");
```

```
Serial.print(" ");
Serial.print(": ");
Serial.print(Sec);
Serial.print(" ");
delay(300);
if (digitalRead(set) == 0)
    {
mIn = Min;
EEPROM.write(add++, mIn);
tmp = 0;
while (digitalRead(set) == 0);
    }
  }
off = 1;
delay(10);
}
void Check()
{
if ( Sec == 30 || Sec == 31 || Sec == 32)
  {
Serial.println("motor runing ...........");
digitalWrite(22, HIGH);
   M = on;
delay(1000);
digitalWrite(22, LOW);
```

```
    M = off;
  }
}
void current()
{
Serial.print(Hor);
Serial.print(": ");
Serial.print(Min);
Serial.print(": ");
Serial.print(Sec);
}
```

APPENDIX B

Model Figure