BACHELOR OF SCIENCE IN ELECTRONIC AND TELECOMMUNICATION ENGINEERING

Design and Implementation of GSM based Cattle Farm Monitoring and Controlling System

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November-2022

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A thesis/project
submitted as partial fulfilment of the requirement for the degree of

BACHELOR OF SCIENCE IN ELECTRONIC & TELECOMMUNICATION ENGINEERING

Department of Electronic and Telecommunication Engineering
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CERTIFICATE OF APPROVAL

The thesis/project entitled as **Design and Implementation of GSM based Cattle Farm Monitoring and Controlling System** submitted by **Imtiaj Morshed,** bearing Matric ID. **T-181028** to the Department of Electronic and Telecommunication Engineering, International Islamic University Chittagong, has been accepted as satisfactory in partial fulfilment of the requirements for the degree of Bachelor of Science in Engineering and approved for the examination held on **15th October, 2022.**

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DECLARATION

It is hereby declared that this work has been done by us and no portion of the work contained in this thesis/project has been submitted elsewhere for the award of any degree or diploma.

Imtiaj Morshed

ACKNOWLEDGMENT

In the name of Allah, the most Beneficent and most Merciful

All praises and glory be to Allah (SWT) for blessing us with opportunities and showering upon us His mercy and guidance all through the life.

We express my gratitude, sincere appreciation and profound respect to our Supervisor Md Ibrahim, Assistant Professor of Electronic and Telecommunication Engineering, International Islamic University Chittagong, for his continuous guidance and advice in order to be successfully finishing the entire thesis work. While working, he has been a sincere mentor to do a quality research from the very beginning. He kept us focused on our thesis and helped us improve the quality of our thesis by giving invaluable feedback.

We would like to thank all faculty members, staff and fellow classmates of the Department of Electrical and Electronic Engineering, International Islamic University Chittagong, for their generous help in various ways for the completion of this thesis. We are also grateful to our parent and families for being extremely supportive while we were doing this work.

Authors

ABSTRACT

Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud and the internet of things (IoT) and GSM – for tracking, monitoring, automating and analysing operations. In this part, we present a system where various kinds of sensors are used to measure the temperature, humidity and food level. Our structure will provide the exact food level of the farm, keep the balanced temperature and auto clean the wastage of the farm. There are two input sensors such as Sonar sensor, Digital Humidity & Temperature sensor, are connected to the microcontroller (Arduino UNO) as input and Sim 800l, Servo & Water pump is connected to the output which will be automatically turned on and turned off with the demand of the system. We can see the result in LCD display and it will send a notification call to our cell phone through GSM Module. The outcome of this study will improve the farm's management practices through the integration of IoT technology that can remotely monitor the Farm.

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LIST OF ABBREVIATIONS

RFID	Radio Frequency Identification
GSM	Global System for Mobiles
SMPS	Switching Mode Power Supply
PSU	Power Supply Unit
PWM	Pulse Width Modulation
LCD	Liquid Crystal Display

CHAPTER 1

INTRODUCTION

1.1Introduction

Monitoring cattle behaviour has become increasingly important in understanding the nutrition, production, management of the wellbeing, and overall health of dairy cows. In the last few years, an interest in the feeding behaviour has resulted in a better understanding of the effect of management and the physiological state of dairy cows. Daily activity patterns, eating, and ruminating are widely considered as indicators closely related to health issues (Huzzey et al., 2007; Weary et al., 2009) and productivity for individual dairy cows. The feeding behaviour of dairy cows traditionally has been determined using intensive research procedures, such as direct observation and time-lapse video recording (Overton et al., 2002). These methods are very labor-intensive and time-consuming (Müller and Schrader, 2003; Elischer et al., 2013), which limits their use over long time periods and for many animals. Methods of assessing behavioural activity have changed in recent years, favouring automatic recording techniques. Automated recording devices for measuring feeding behaviour and feed intake of cattle are being used more and more widely (Krawczel et al., 2012; Bikker et al., 2014; Chizzotti et al., 2015). The development of automated monitoring systems that can continually and accurately quantify feeding bebehaviorould provides an early warning tool for efficient monitoring and control of modern and automated dairy farms.

Precision dairy farming refers to the use of technologies for managing individual animals to improve management strategies and farm performance. The ability to monitor the health of only the herd is antiquated and leads to a great disparity between expected farm results and the actual results. Modern dairy farming is constantly focusing more attention to individual cow health and productivity. There are several benefits to the individual monitoring of a cow. A sick cow can be identified and removed from the herd much sooner to protect herd health. Determining optimal reproductive times can be monitored as well as individual calf delivery to avoid the loss of calves to death or disease. The diet of each individual cow can be rationed to fit their specific dietary needs to ensure maximum milk yields. One precision dairy farming technology, feed intake monitoring, is very beneficial in tracking more than just dietary health of the individual cow. Individual feed monitoring helps to monitor the productivity of each cow versus the quantity of feed being consumed. This aids in farm budgeting, milk yield forecasting, and feed nutrition rationing. When feed is wasted by a cow that is a direct loss of profit from the farm, as the money spent on that feed cannot be recovered. Being able to forecast milk production is essential for budgeting and resources management in a dairy farming operation as decreasing milk yields can lead to huge losses for the dairy farming operation. Ration balancing is important for maintaining and improving the herd diet. In general, the healthier the cow eats and the more feed it consumes, the greater the milk yield. By keeping track of how much feed the individual cow consumes, the producer can determine what combination of feedstuffs they prefer and in what rations. Feedstuffs are the feed ingredients used in mixing a feed ration that is balanced, meets dietary needs, and helps promote individual cow health and productivity. In this manner, feed does not go to waste as often and in smaller amounts than traditional feed rationing without feed intake monitoring. Currently, there are only a handful of methods that work to identify how much feed is distributed to or consumed by a dairy cow. Each of these feed intake monitoring methods has its own benefits as well as a degree of faults. One method is visual inspection, which relies upon guessing how much feed is distributed and consumed. However, the difficulty in manually collecting data at the time of feeding has limited the extent of this type of monitoring [1]. The problem here is that you only get the best estimate of the distribution and consumption. This method does not tell you accurately how much the cow actually ate. The waste feed is rarely if ever quantified in dairy production with this method. The feed that goes to waste is typically all collected together and sent to compost with no record of individual consumption. The second method of feed intake monitoring is employing an electronic system that will automatically record feed intake data. The most common practice here is to utilize radio frequency identification (RFID) to monitor the consumption by individual cows. Common systems that utilize this technology include GrowSafe [2] and Calan Gates [3], just to name a few systems. An RFID transponder located on the cow, typically in an ear tag or collar, interacts with an RFID reader located at the feeding area for traceability of an individual animal. In order to read the low-frequency multiple RFID tags at once, the Grow safe system developed a mat that is to be placed in front of feeders that collects individual cow data simultaneously. Most of the research completed in this area focuses on feeding behaviour with feed intake only a secondary focus or as supporting informative 3 data, such as the research studies conducted by E. D. M. Mendes et al. [4], P. D. Krawczel et al. [5], T. J. DeVries et al. [6], and N. Chapinal et al. [7]. The purpose of this study is to develop a feed intake monitoring system that quantifies how much feed is distributed to the individual cow as well as how much is actually consumed. A machine vision system was chosen and implemented, in particular a 3D imaging system, to record and monitor the change in feed bins before and after feeding. In this manner, the producer will have a more accurate record of how much feed the cow is actually consuming as opposed to what the producer believes the cow is consuming. This can greatly aid in early detection of sickness or other health issues, monitoring milk output, feed efficiency, and several other factors of day-to-day dairy production that affected the health and profitability of the farm. The incorporation of a machine vision system is optimal as the system can be placed in an area that does not obstruct the workflow of the farm, does not add additional work, and does not interfere with the feeding habits of the dairy cow. The novelty of this study is that a system is proposed and tested that has the capability to accurately record as near a true value of feed consumption and feed efficiency as possible. Our solution is to use computer-automated inspection from video surveillance in order to monitor feed intake. The system represents a marked improvement over existing systems or evaluation methods that only consider the amount of feed distributed and not the total amount actually consumed. The system setup is novel in its own right, as other existing technologies do not incorporate the SLI technology that this setup employs. With increasing numbers of livestock farmers, the food industry and agriculture demand an efficient and effective control and monitoring of different physical parameters for growth and food safety. Due to its revolutionary invention electronics has a major role not only in controlling and monitoring of environment but also acquires different physical statuses of animals like temperature, heart rate, and other receptors.

1.3 Motivation

Presently, the farm owner is using manual feed measurement methods and cannot check or maintain the temperature. An optimum condition of temperatures like heat and cooling is necessary for a Farm. Sometimes the farm owner or worker remains unconscious about food level or temperature level. Other than that, using manual methods can be the reason behind an unhealthy farm. Furthermore, the owner can get notified by a phone call about the decrease in food levels.

1.4 Objective

The details objective of this project are given below:

- To Study about traditional cattle firm management.
- To design a GSM based Cattle monitoring system.
- To develop a low-cost Cattle monitoring system.
- To Monitor Food percentage, Temperature of the cattle farm.

1.5 Thesis Outline

The thesis is organized as follows:

- **Chapter 1** includes what was our motivation and what is the background behind this project.
- **Chapter 2** includes what was the previous works in this sector and what they did.
- **Chapter 3** describes the specific components and their description.
- **Chapter 4** describes the methodology of the proposed model
- **Chapter 5** includes our overall output and our discussions about our project.
- **Chapter 6** describes the Comparative study between our works and previous works in this sector, conclusions of our project and future work plan for our project.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Smart agro farming technologies are new to the agro farming industry, and it will undoubtedly take time for them to become adopted and integrated into everyday operations. Much progress has been made in the past few years towards realizing this goal, with technologies such as computerized milk yield recordings, biometric identification, and health monitoring systems being readily adopted. In order for the dairy industry to continue to increase its production output capabilities and maintain herd health, further adoption of precision dairy farming practices must be promoted and accepted by large scale commercial operations as well as small scale independent family dairy producers. One such technology area is feed intake monitoring systems, which monitor how much feed is given to each cow, and how much of it is consumed by the individual cow.

2.2 Literature Review

Several techniques have been attempted and various methods used to advance the realization of practical feed intake monitoring systems that are cost-effective and beneficial to all dairy operations. In order to understand the importance of feed intake monitoring in dairy cows, it is first important to understand the feed intake of a dairy cow. Research in this area requires knowledge of both nutrition and behavior [1]. Dairy cows need to consume a lot of feed to achieve today’ s expected milk production. According to Dr. Lee Chiba, feed represents about 50 percent of the total production costs and, therefore, the feeding program more than any other single factor can determine the productivity of lactating dairy cows and the profitability of the dairy farm [2]. About 75 percent of the differences in milk production between cows is determined by environmental factors with feed making up the largest portion of these differences, reports Dr. Chiba. There is a close 5 relationships between milk production, dry matter intake, and body weight changes that must be considered throughout the lactation cycle of a dairy cow. There are four phases to the lactation cycle of a dairy cow. The first phase is the Early Lactation Phase and it typically lasts between 0 to 70 days, or about 10 weeks. This phase is important as milk production increases rapidly the following calving, peaking at 4 to 10 weeks after calving [3]. Because feed intake lags behind milk production, body fat will be mobilized to meet energy requirements for milk production [2]. Professor Michael Looper of the University of Arkansas states after calving, most cows can eat 20 pounds of grain per day if healthy [3]. The second phase is the Peak Dry Matter Intake Phase and typically last 70- 140 days, or again about 10 weeks in duration, into the lactation cycle. This period is marked by slowly declining milk production after reaching peak production. Feed intake should be near maximum and can supply nutrients for the cows, according to Michael Looper, and cows should be maintaining weight or slightly gaining. Grain should be fed according to the level of production as well as the cow’ s individual body condition score [3]. The third phase is the mid to Late Lactation Phase and occurs in the 140-305 days of the lactation cycle. The dry matter intake exceeds the needs during this phase because this is the main period to restore body reserves for the next upcoming lactation cycle. This phase is characterized as a period of declining milk production and should be the easiest to manage, says Michael Looper. The cows should be pregnant and animals should be slightly gaining weight so that they will be in a body condition score of 3.5 to 4 on a 5-point scale at dry-off. Michael Looper also claims that a drop in milk production of 6 of 8 to 10 percent per month is normal throughout the declining phase of milk production [3]. The fourth phase is the Dry Period Phase and is characterized as the 50-60 days before the next lactation cycle begins or the last 50-60 days of the current lactation cycle. The dry period is a critical phase of the lactation cycle, according to Michael Looper, since a sound dry cow program can increase milk production or severely affect milk production during the following lactation and it can serve to minimize metabolic problems around the time of calving [3] Maximizing dry matter intake in early lactation is very important [4]. Overestimation or underestimation of dry matter intake can be very costly if milk production is compromised. Professors John K. Bernard and Monty J. Montgomery of the University of Tennessee state that lactating dairy cows must consume large quantities of dry matter to provide the nutrients needed to maintain high levels of milk production and that the consequences of low dry matter intake are lower peak milk yields, lower total milk production, excessive loss of body weight, and poor reproductive performance [5]. According to professors Bernard and Montgomery, research has shown a two-pound increase in milk production for each pound increase in dry matter intake and as milk production continues to increase, management of dry matter intake becomes more critical [5]. A number of factors affect dry matter intake, including forage quality, nutrient balance of rations, feeding method, ration palatability, moisture content, environmental stress, physical facilities, and general management practices [5]. Feed should be available whenever the cows want to eat [13]. Rick Grant states that the times when bunks are often empty and cows typically eat are right after milking 7 and during freestall and alleyway scraping [6] As well, Rick Grant believes that producers should work to minimize the time spent in holding areas and the milking parlor [6]. In general, the maximum amount of time that cows should be without access to feed is 6 to 8 hours daily, according to Rick Grant, because, beyond this point, significant declines in dry matter intake will occur [6]. The cow in this research study are fed at 1pm every day and their feed bins are checked again around 7pm every day. This allows the individual cow to eat as much as possible from the first bin during this 6-hour period before the feed from the second bin is offered to the cow. Rick Grant reports that, generally, 65 to 70 percent of daily dry matter intake occurs during daylight [6]. J.L. Albright of Purdue University states that cow have a distinct diurnal grazing pattern, which includes a major meal beginning approximately at sunrise [7]. Further, J.L. Albright indicates that cow are crepuscular, that is, most active at sunrise and again at sunset [7]. T. J. DeVries et al. also note this diurnal feeding pattern in their research as it suggests feeding is most active just before and after milking times [8]. As the feeding frequency is allowed to increase, the amount of feed consumed increases. Feed efficiency is another important component in monitoring herd health and feed intake. According to Michael F. Hutjens of the University of Illinois, feed efficiency reflects the level of fat- corrected milk yield produced per unit of dry matter consumed with an optimal range of 1.4 to 1.8 pounds of milk per pound of dry matter while values in the field can vary from 1.1 to 2.0 pounds of milk per pound of dry matter intake [9]. According to Michael Hutjens, the " new focus" on maximizing efficiency reflects as cows consume more feed, digestive efficiency decreases as the relationship between net energy-lactation intake and milk production is subject to diminishing 8 returns [9]. The " traditional focus" was that as cows consume more feed to support higher milk production, the proportion of digested nutrients captured as milk is proportionally higher [9]. With lower milk prices, one way to maintain profitability without sacrificing milk production or herd health is by enhancing feed efficiency, states Michael Hutjens [9]. Days in milk, age, growth, changes in body condition score, body weight, forage quality, feed additives, and environmental factors will impact feed efficiency values [9]. Michael Hutjens reports that actual feed intake is critical for an accurate feed efficiency value and feed refusals should be removed (subtracted) as this feed has not been consumed [9]. The amount of dry matter intake is one of the most discerning factors in milk production. In order to manage dry matter intake, producers must take it upon themselves to monitor the dry matter intake of their dairy cows. Promoting feed intake by lactating dairy cows is critical in terms of improving milk production, health, and body condition of the animal [10]. Understanding what causes declines and increases in feed intake will help producers to make more informed decisions as well as helping to maintain and support higher milk yields and the overall profitability of the dairy.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The project is built with various sensors and they take data by sensing from the environment for temperature monitoring. The sensors take analog data from the environment which later is converted into digital with the help of Arduino and then sent to the LCD display to show the data.

3.2 Methodology

The Proposed model of the system is as follows. **Fig. 3.1** shows how the whole system will work. The device will be set up to take the data and there will be a base standard value shown on the LCD Display. The sensors will collect data and based on the set values it will show the output in Display. The following **Fig. 3.1** shows the proposed model system.

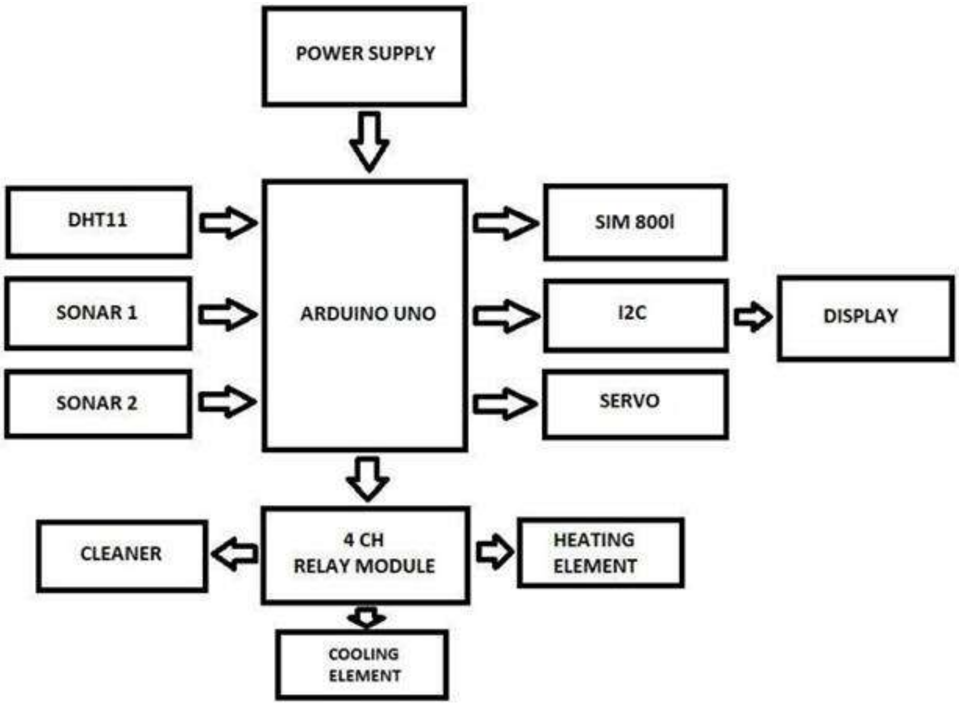

Fig. 3.1 Block Diagram of Proposed System

Here two input sensors such as a Sonar sensor, Digital Humidity & Temperature sensor, are connected to the microcontroller (Arduino UNO) as input, and Sim 800l, Servo &

Water pump is connected to the output which will be automatically turned on and turned off with the demand of the system. We can see the result in the LCD display and it will send a notification call to our cell phone through GSM Module.

3.3 Circuit Diagram of proposed model

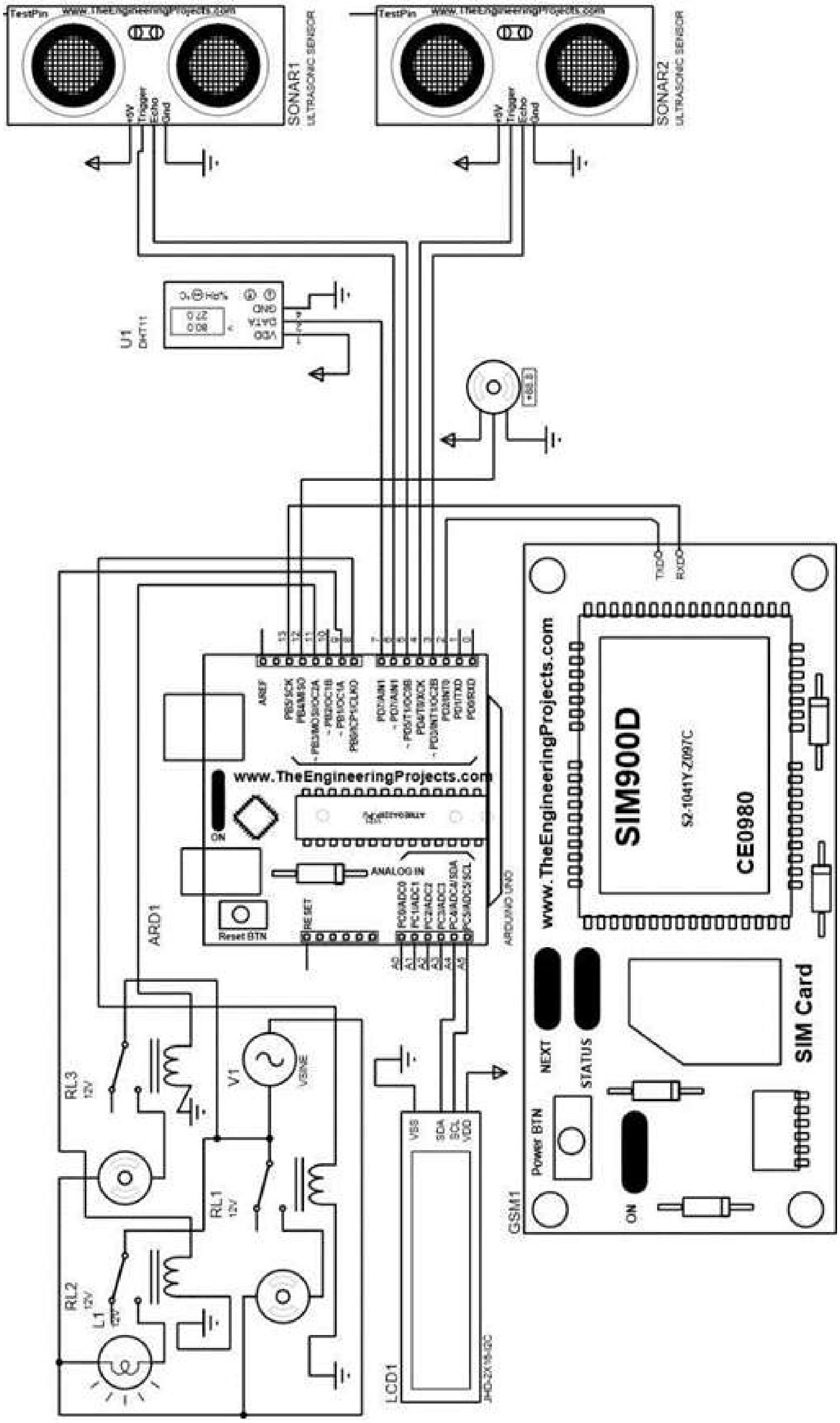

Fig. 3.2 Circuit diagram of the Propose model

The following **Fig. 3.2** is the Circuit diagram of proposed model. Here we are watching two sonar sensor, which is directly connected with ARDUINO UNO. A relay module is used here to control the fan, motor, and light. The relay module is also connected with ARDUINO. We used a servo motor, DC fan, and light for cleaning, temperature controlling, and cooling. Here the main development board is ARDUINO UNO. Which is connected with a 16*2 LCD.

3.4 Prototype of the proposed System

The **Fig. 3.3.** Shows the Prototype of the proposed System.

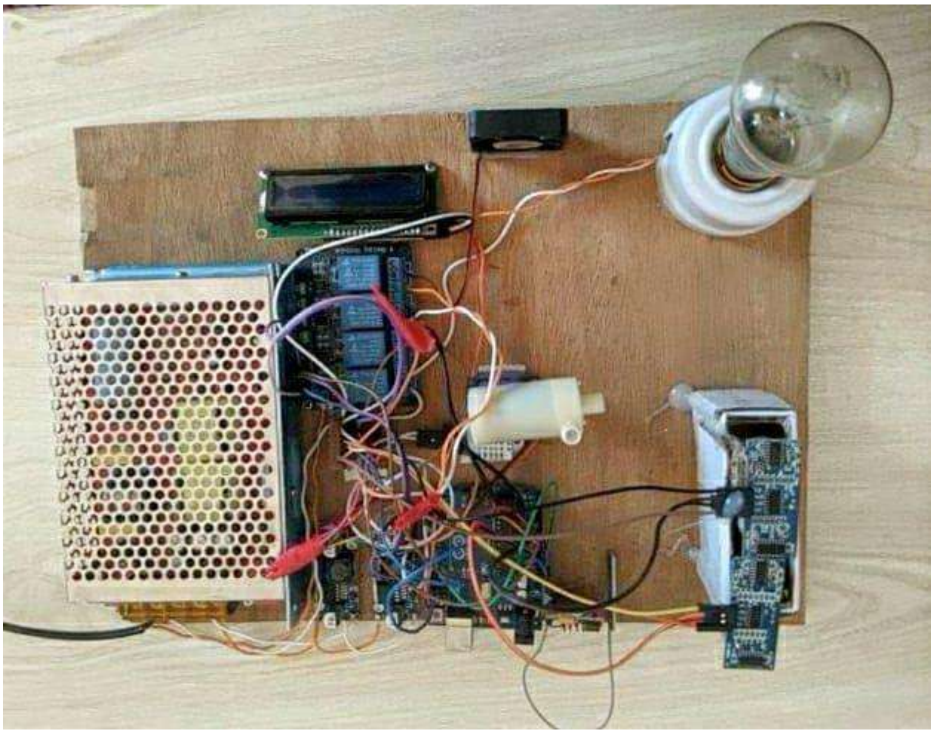

Fig. 3.3 Prototype of the proposed System

Here we are watching the main board of our project. Here we watching a power supply of 12V and 10Amp. We used two buck converter to step down the voltage. One buck converter is for GSM and another is for full project purposes. GSM module is for taking the message and giving the message. The main development board is ARDUINO Uno. The microcontroller is AT MEGA328p. An LCD monitor consisting of 16*2 is connected to the board for showing data. WE have used a relay module to control the fan, the light, and the servo motor. We are using two sonar sensors for measuring the food level, which is with ARDUINO Uno.

3.5 Components of the Project

The project is built with various sensors and they take data by sensing from the environment for temperature monitoring. The sensors take analog data from the environment which later is converted into digital with the help of Arduino and then sent to the LCD display for showing the data.

This device is consisting of the following components:

- SMPS Power Supply
- DHT 11
- Buck Converter
- 4 channel Relay Module
- Arduino Mega
- BMP 280
- Sim 800L GSM
- 16x2 LCD Display with I2C Module
- Sonar Sensor
- Servo Motor
- 6V Pump Motor
- 12V Cooler Fan
- Light Holder
- AC Light
- Connecting Wires

3.5.1 SMPS Power Supply

Fig. 3.4 SMPS Power Supply [11]

Fig. 3.4 shows that, SMPS power supply. Switch Mode or Switching Mode Power Supply or simply SMPS is a type of Power Supply Unit (PSU) that uses some kind of switching device to transfer electrical energy from source to load. Usually, the source is either AC or DC and the load is DC. The most common application of an SMPS is the power supply unit of a computer. Switching Mode Power Supply (SMPS) has become a standard type of power supply unit for electronic devices because of its high efficiency, low cost and high power density.

SMPS Power Supply Specifications:

Efficiency:	Typical efficiency of 60-95% can be achieved with good design
Output Voltage:	Can be more or less than input
Regulation Method:	By varying duty cycle of PWM
Noise and Interference:	High interference and noise due to frequent switching of current
Applications:	High power, complex and stable power requirements

3.5.2 DHT 11 Temperature and Humidity Sensor:

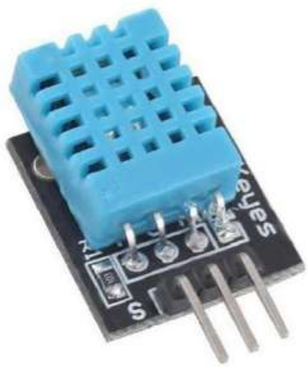

Fig. 3.5 DHT 11 Temperature and Humidity Sensor [12]

Fig. 3.5 shows a DHT11 sensor. DHT11 Temperature & Humidity Sensor states a temperature & humidity sensor compound with a calibrated digital signal output. By using the high-class digital-signal acquisition technique and temperature & humidity sensing technology, it guarantees high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, which offers excellent quality, fast response, ant interference ability and cost-effectiveness. The Fig. 3.2 shows DHT 11 Temperature and Humidity sensor. DHT11' s power supply is 3-5.5V DC. When power is supplied to the sensor, it does not send any instruction to the sensor in within one second in order to pass the unstable status. One capacitor valued 100nF can be added between VDD and GND for power filtering.

3.5.3 Buck Converter:

Fig. 3.6 Buck Converter [13]

Fig. 3.6 is a Buck Converter. A buck converter (step-down converter) is a DC-to-DC power converter which steps down voltage (while drawing less average current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) typically containing at least two semiconductors (a diode and a transistor, although modern buck converters frequently replace the diode with a second transistor used for synchronous rectification) and at least one energy storage element, a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter). It is called a buck converter because the voltage across the inductor " bucks" or opposes the supply voltage.

Switching converters (such as buck converters) provide much greater power efficiency as DC-to-DC converters than linear regulators, which are simpler circuits that lower voltages by dissipating power as heat, but do not step up output current. The efficiency of buck converters can be very high, often over 90%, making them useful for tasks such as converting a computer's main supply voltage, which is usually 12 V, down to lower voltages needed by USB, DRAM and the CPU, which are usually 5, 3.3 or 1.8 V.

3.5.4 4 Channel Relay Module

Fig. 3.7 4 Channel Relay Module [14]

In the following **Fig. 3.7**, this is a 4 Channel Isolated 5V 10A Relay Module, A wide range of microcontrollers such as Arduino, AVR, PIC, ARM and so on can control it. It is also able to control various appliances and other types of equipment with a large current.

Relay output maximum contact is AC250V 10A and DC30V 10A. One can connect a microcontroller with standard interface directly to it. Red working status indicator lights are conducive to the safe use. It has a wide range of applications such as all MCU control, industrial sector, PLC control, smart home control.

Ready to get switching on your Raspberry Pi? This neat relay module features 4 x 5V relays rated at 10A/250V each. It is designed to switch up to 4 high currents (10A) or high voltage (250V) loads with the help of microcontroller

3.5.5 Arduino Uno

Fig. 3.8 is an Arduino UNO. It is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

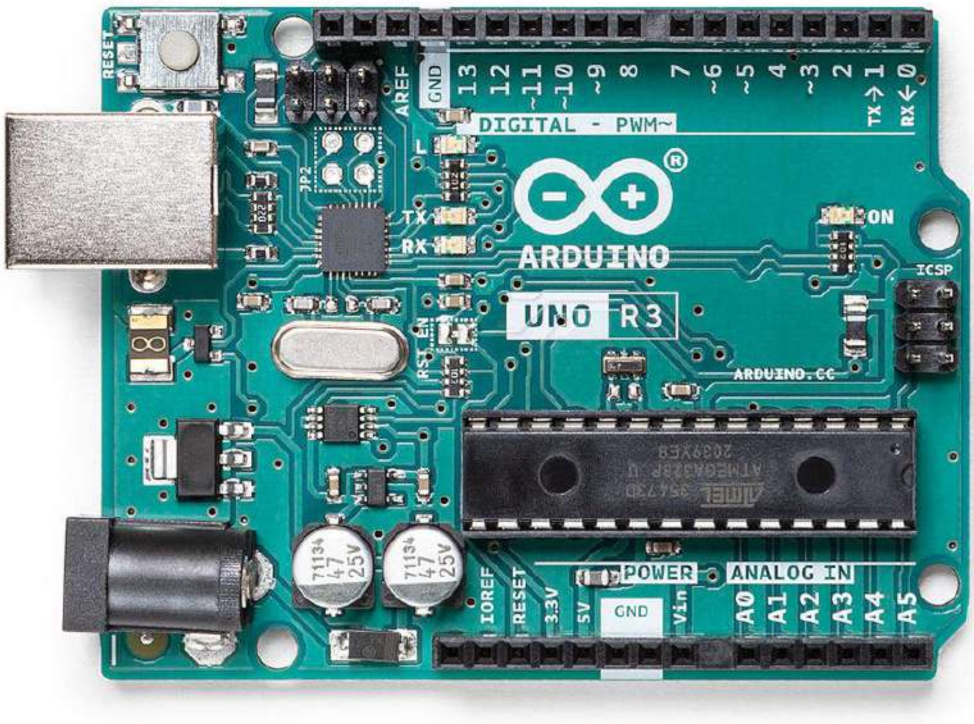

Fig. 3.8 Arduino Uno [15]

Technical Specifications

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 can provide PWM output)
- PWM Pins: 6 (Pin # 3, 5, 6, 9, 10 and 11)
- UART: 1
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz

3.5.6 BMP280

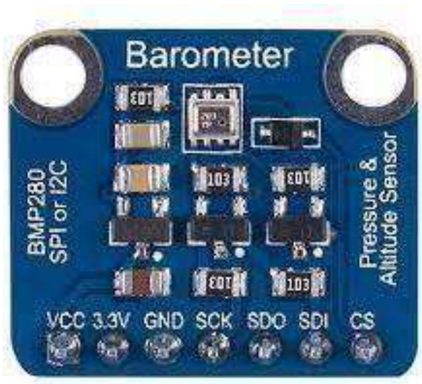

Fig. 3.9 BMP280 [16]

The following **Fig. 3.9** is a BMP280. This BMP280 is a cheapest and tiny Atmospheric Sensor Breakout to measure barometric pressure, and temperature readings all without taking up too much space. Basically, anything you need to know about atmospheric conditions you can find out from this tiny breakout. The BMP280 Breakout has been design to be used in indoor/outdoor navigation, weather forecasting, home automation, and even personal health and wellness monitoring.

3.5.7 Sim 800L GSM

Fig. 3.10 Sim 800L GSM [17]

Fig. 3.10 shows a SIM800L GSM/GPRS module which is a miniature GSM modem, which can be integrated into a great number of IoT projects. You can use this module to accomplish almost anything a normal cell phone can; SMS text messages, Make or receive phone calls, connecting to internet through GPRS, TCP/IP, and more! To top it off, the module supports quad-band GSM/GPRS network, meaning it works pretty much anywhere in the world.

3.5.8 16×2 LCD Display

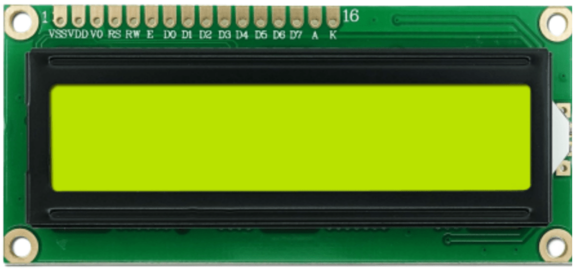

Fig. 3.11 16x2 LCD Display [18]

Fig. 3.11 shows a LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produces an image using a backlight.

3.5.9 Sonar Sensor

Fig. 3.12 Sonar Sensor [19]

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. **Fig. 3.12** shows an ultrasonic sensor. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1” to 13 feet.

The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

3.5.10 Servo Motor

Fig. 3.13 Servo Motor [20]

Here **Fig. 3.13** shows a servo motor. A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision Servo motors are rated in kg/cm (kilogram per centimetre) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity.

3.5.11 6V DC Pump Motor

Fig. 3.14 6V DC Pump Motor [21]

Fig. 3.14 shows a low cost, small size Submersible Pump Motor which can be operated from a 2.5 ~ 6V power supply. It can take up to 120 liters per hour with very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. Dry run may damage the motor due to heating and it will also produce noise.

3.6 Software Requirements

1. Aurdino IDE 1.8.8

CHAPTER 4

RESULT AND DATA ANALYSIS

4.1 Introduction

This chapter is all about our device’ s experiment and its results. We put our devices in different situations to get data as much as possible.

4.2 Output of the System

Fig. 5.1 is showing the operational view of our project. Here we can see all the components successfully took the power and connected with Arduino. All the component has already been discussed in **Fig. 4.3**.

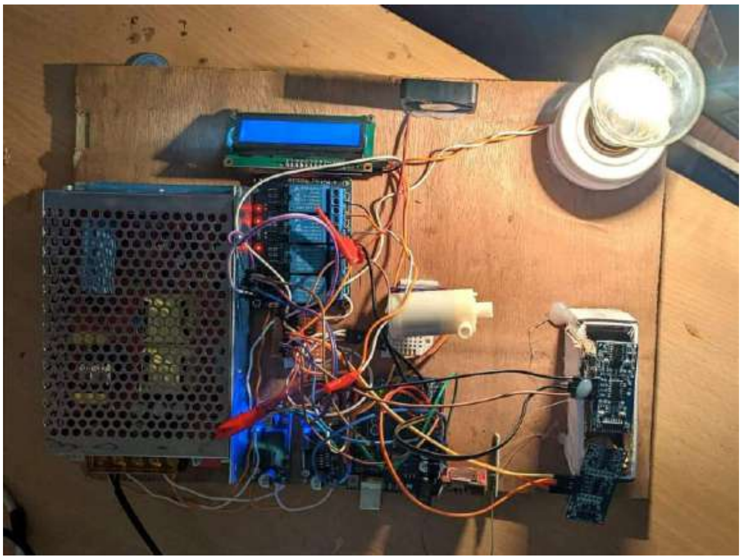

Fig. 4.1 Project View (real scenario)

4.3 Displaying data of output result

Fig. 4.2 (a) Displaying the food level data

Fig. 4.2 (b) Displaying the weather output data

Fig. 4.2(a) is showing the food level. We measured the food level by using two sonar sensors. Here we used two cups for feeding cattle. That is why it is watching two food levels.

Fig. 4.2(b) is showing the humidity and temperature. Humidity and temperature are the most important things for a farm. Here we used DHT11 to measure humidity and temperature.

4.5 Result

Here a smart low cost cattle monitoring system using GSM Technology has been developed by which we can monitor temperature and humidity, Food Level of individual cattle. When Temperature goes down, a heater will be automatically ON to balance the standard temperature. When Food Level goes down, a SMS has been sent to mobile via gsm. And also, a motor pum to wash cattle farm will be automatically start upon time.

4.6 Cost Analysis

Table 4.1 is showing the total cost and expenses we have already done for this project. It took an overall 5715 BDT. But our first GSM was not operational for this reason we brought another one, and we took a sonar extra. Hence, manufacture cost will be lesser than this prototype as bulk amount of product have to be purchased.

Table: 4.1 COST ANALYSIS OF THE PROJECT.

Equipment	**Quantity**	**Price (Taka)**
SMPS Power Supply	1	880 tk.
DHT 11 sensor	1	180 tk.
Buck Converter	1	250 tk.
Arduino UNO	1	1100 tk.
BMP 280	1	280 tk.
Sim 800L GSM	1	1000 tk.
4 Channel Relay	1	290 tk.
16x2 LCD Display	1	240 tk.
I2C Module	1	170 tk.
Sonar Sensor	2	200 tk.
Servo Motor	1	195 tk.
6v DC Motor	1	100 tk.
12v Cooler Fan	1	150 tk.
Light Holder	1	30 tk.
AC Light	1	50 tk.
Connecting wire	-	200 tk.
Wooden Board	1	400 tk.
Total		**5715 tk**

4.4 Comparative Study

In all of the previous work, they worked only on the Cattle feeding system and temperature monitoring systems individually. They only worked on the amount of food and heating system but they didn’ t discuss the cleaning system which are the main things for implementing a smart agro farm.

CHAPTER 5
CONCLUSION AND FUTURE WORK

5.1 Introduction

Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud, Internet of Things (IoT) and GSM – for tracking, monitoring, automating and analysing operations.

5.2 Conclusion

This project aims to provide insights for other researchers to construct a smart cattle farm monitoring system that can effectively aid and minimize the management loads of the cattle owner while being able to see various activities of cattle livestock. We have built a temperature balancing system and smart solution to food level detection. Also create an automated system to wash cattle farm upon time.

5.3 Applications and Advantage

Here we are watching the main board of our project. Here we watching a power supply of 12V and 10Amp. We used two buck converter to step down the voltage. One buck converter is for GSM and another is for full project purposes. GSM module is for taking the message and giving the message. The main development board is ARDUINO Uno. The microcontroller is AT MEGA328p. An LCD monitor consisting of 16*2 is connected to the board for showing data. WE have used a relay module to control the fan, the light, and the servo motor. We are using two sonar sensors for measuring the food level, which is with ARDUINO Uno.

- It is the system we have developed for monitoring and controlling a firm.
- We also maintained food percentage, temperature and humidity.

5.6 Limitations

- Our experiment is not fully automated. We have to provide food manually when the food is over.

- In our experiment there is no machine to machine communication. That’ s why when a system will fall, it cannot notify us automatically.
- In our system we didn’ t use Solar Panel. There will need a lot of power consumption. Somehow if power fall, then the whole system will fall down.

5.7 Future work

- To implement this system in real life case.
- To Use Solar power for power.
- To use Artificial Neural Network for forecasting food consumption.

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APPENDIX

Microcontroller Code of the proposed model

```
#include <SoftwareSerial.h>
#include <HCSR04.h>
#include "DHT.h"
#include <Wire.h>
#include <Servo.h>
#include <LiquidCrystal_I2C.h>

HCSR04 hc1(5, 6); //initialisation class HCSR04 (trig pin, echo pin) HCSR04 hc2(3, 4);
Servo myservo;
#define DHTPIN 7
#define fan 8
#define light 11
const int cleanPin = 9;
int cleanPinState ;

unsigned long food1previous = 0;
int pos=0; //Alarm reciever's phone number with country code const String PHONE =
"+8801992130514";

#define rxPin 13
#define txPin 2
SoftwareSerial sim800(rxPin,txPin);

unsigned long previousMillis1 = 0; unsigned long previousMillis2 = 0;

const long interval1 = 10000;
const long interval2 = 60000;
LiquidCrystal_I2C lcd(0x27, 16, 2);
DHT dht(DHTPIN, DHT11);
//int pos = 0;

void setup()
{
Serial.begin(115200);

sim800.begin(9600);
Serial.println("SIM800L software serial initialize");

dht.begin();
lcd.begin();
lcd.backlight();
lcd.setCursor(3,0);
lcd.print("SMART AGRO");
lcd.setCursor(4,1);
lcd.print("FIRMING.");
delay(2000);
```

```
lcd.clear();

pinMode(fan,OUTPUT);
pinMode(light,OUTPUT);
pinMode(cleanPin, OUTPUT);
myservo.attach(12);

sim800.println("AT"); delay(1000);
}

void loop()
{

while(sim800.available())
{ Serial.println(sim800.readString());
}
while(Serial.available())
{ sim800.println(Serial.readString());
}

lcd.clear();
float h = dht.readHumidity();
Serial.print("HUM"); Serial.println(h);
lcd.setCursor(0,0);
lcd.print("HUMIDITY: ");
lcd.print(h);


float t = dht.readTemperature();
Serial.print("temp");
Serial.println(t);
lcd.setCursor(0,1);
lcd.print("TEMP : ");
lcd.print(t);
lcd.print(" C");

delay(1000);
lcd.clear();

if(t>=34){ digitalWrite(fan,LOW);
Serial.println("HIGH TEMP");

}
else{ digitalWrite(fan,HIGH);
}

if(t<=29){ digitalWrite(light,LOW);
}

else{ digitalWrite(light,HIGH);
```

```
}


float food1 = hc1.dist();
Serial.print(food1);
Serial.print("CM  ");
//delay(300);
lcd.setCursor(0,0);
lcd.print("FOOD1: ");
lcd.print(food1);
lcd.print(" CM");

float food2 = hc2.dist();
Serial.print(food2);
Serial.println("CM");

lcd.setCursor(0,1);
lcd.print("FOOD2: ");
lcd.print(food2);
lcd.print(" CM");
delay(1000);
lcd.clear();

if (food1>=5){

lcd.setCursor(2,0);
lcd.print("FOOD1 FINISH");
delay(1000);
Serial.println("food1 finfish");


}

if (food2>=5){

lcd.setCursor(2,1);
lcd.print("FOOD2 FINISH");
Serial.println("food2 finfish");
delay(1000);

}

if (food1>=5 || food2>=5){
if(millis()-food1previous>=5000)
{ food1previous = millis(); sim800.println("ATD"+PHONE+";");


}
}
```

```
//	else{
//	digitalWrite(fan,HIGH);
//	digitalWrite(light,HIGH);
//	}

unsigned long currentMillis1 = millis();

if (currentMillis1 - previousMillis1 >= interval1)
{ previousMillis1 = currentMillis1;
if (cleanPinState == LOW)
 { cleanPinState = HIGH;
}


digitalWrite(cleanPin, cleanPinState);
}

//...............................................
unsigned long currentMillis2 = millis();

if (currentMillis2 - previousMillis2 >= interval2) { previousMillis2 = currentMillis2;
if (cleanPinState == HIGH) { cleanPinState = LOW;
}


digitalWrite(cleanPin, cleanPinState);
}
if(cleanPinState == LOW){

lcd.clear();
lcd.print(" START CLEANING ");
for (pos = 0; pos <= 180; pos += 1) { myservo.write(pos);
delay(15);
}
for (pos = 180; pos >= 0; pos -= 1) { myservo.write(pos);
delay(15);
}
//	for (pos = 0; pos <= 180; pos += 1) {
//	myservo.write(pos);
//	delay(15);
//	}
//	for (pos = 180; pos >= 0; pos -= 1) {
//	myservo.write(pos);
//	delay(15);
//	}
}
else{ myservo.write(0);
```