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DESIGN AND FABRICATION OF AUTOMATIC POULTRY FOOD FEEDING SYSTEM

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Abstract: The Design and Development of Automatic Poultry Food Feeding System is to automatically feed poultry at a given period of time and to alert user when the feeds are running out of supply. The fundamental idea of this project is automation utilising Embedded C programming to distribute food. This feeder is operated by moving around the barn by IR Sensors installed in feeder system Therefore, the proposed method is more efficient than manual conventional way of feeding because less effort will be needed in feeding the chickens and less feeds will be wasted. In this work, the detail design of the feeder system is described and preliminary experiment to show the usefulness of the propose system is reported.

Keywords: Feeder System, Automation, Embedded C Programming, IR Sensors

I.INTRODUCTION

Poultry farming such as chicken production in Malaysia has risen rapidly due to increasing demand [1-2]. Conventional poultry farming system is using traditional free-range farming where the poultry such as chickens and ducks are raised in open coop and allowed to roam freely during the day. This conventional poultry farming system requires more work load because poultry need to be fed regularly to be more productive. Furthermore, conventional method used manual feeding system which requires human workforce.This method has disadvantages because the farmers cannot ensure every poultry are being fed in the same amount [3].

Cage system and deep litter system of rearing poultry are popular and well-known poultry rearing methods in farming industry. Cage system is a system of rearing birds that utilizes cage where birds is kept in several cages that are arranged in single or multiple rows [4]. Deep litter system is a system of rearing poultry in housings scattered with hash straw, saw dust, dried leaves or nut kernels on the floor area.

The deep litter system is more frequently utilized worldwide and more popular than cage system [5-7]. Although deep litter system is more popular than cage system, but it has several disadvantages than cage system. For example, deep litter system requires the feeder to be always kept dry and clean. The barn should be well ventilated, and the litter should be cleaned at least once in a week or if required. Litter needs to be changed promptly to prevent the growth of bacteria that can affects chicken production. Therefore, litter system needs additional work load than cage system. Besides, the feed given is not fixed for every chicken and mostly it will cause more feed wastage compare to the cage system where cage system has immediate steps to control the feed wastage. On the other hand, for cage system in term of feeding efficiency and the produced egg weight were better compared to the deep litter system [8-9]. In short, the cage system also provides greater number of chickens reared per unit of area compared to deep litter system [4]. Therefore, this project focuses on improving poultry feeding method in cage system. The rapidly advancement of technology in agriculture can make it possible to invent and implement cage system for poultry rearing utilizing automation to make the process easier.

Figure 1: Feeder System Setup

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This feeder system is expected to reduce labor demand in poultry rearing especially focusing in chicken rearing, where the increasing labor cost in poultry rearing and herd sizes have led to significant interest in the use of automation.

II. LITERATURE REVIEW

According to Navaneeth (2015), the growing need for poultry products by consumers has urged the necessity for small and medium scale poultry farmers to meet up the demand since they supply the bulk need of the market especially in the developing countries. There exist the need to produce birds that will meet the market standards within the shortest time without straining the farmer's time, resources and energy. In this project work an effort made to develop a labor or time saving automatically operated automatic feeder that will optimize feeding of birds. There exists many automated equipment's to feed birds in large scale poultries. But it is difficult or not possible to include large scale equipment's in small medium scale poultries. Normally small and medium scale poultries are run by farmers of rural areas. In small scale and medium scale poultries birds are fed with the feeder which requires frequent refilling of food. This consumes more labor and time increasing expenditure for farmers. With a view to facilitate easy and efficient feeding of food to chickens in small and medium scale poultries, it was proposed to design and fabricate an automatically operated poultry feeder.

According to Umogbai (2013), a mechanical family poultry feeder was done in an effort to provide a labour or time saving mechanically operated automatic feeder that will optimize feeding of birds in family poultry and small or medium scale poultry farms.

According to Reyes et al., (2015) poultry is a great potential industry particularly in Batangas Province. The method of feeding chicken needs to be considered as chicken must be fed regularly to be more productive. The conventional method of feeding chicken is the need to continuously provide the food, be alert and conscious on the food remaining in cages and to feed the chickens in a correct period of time to avoid the decline of the production.The study was conducted in SPAMAST Buhangin Campus. It has acquired an 8-hectare land in Brgy. Buhangin, Malita, Davao Occidental which served as field laboratory for instructional purposes, income generating projects and has a general education building constructed for instructional purposes, classrooms and laboratories. The students of SPAMAST Buhangin Campus used manual method in feeding and providing adequate water for the poultry. Sometimes they forgot to feed the chickens on time since in some cases they are busy in doing their activities and research.

According to Prieto,(2014), Automated Poultry Feeder with SMS Notification automates the poultry feeding and watering system. This project involves hardware component such as arduino and GSM module for it insure the functions work properly. It will improve the methodology and systematic method in terms of poultry feeding.A poultry feeder for feeding birds in their early stages of growth, having a rectangular-rounded shape, comprising: a clamp for embracing a food supply tube; a holding throat for holding the clamp; a shutter for limiting the food supply; a hopper coupled to the holding throat for distributing the food; a food receiving plate integrally coupled to said hopper; wherein the holding throat is bifurcated and surrounds the clamp; wherein the hopper extends from the holding throat; wherein the clamp, which has a cylindrical shape, comprises three sections: a left lateral section; a central section and a right lateral section, and is formed by an upper half and a lower half, wherein said upper and lower halves are symmetrical and semi-cylindrical; wherein the upper half of the clamp comprises: an upper left lateral section, an upper central section and an upper right lateral section; and the lower half of the clamp comprises a lower left lateral section; lower central section, and a lower right lateral section; wherein the central section having a width and a diameter which are greater than a width and a diameter of the lateral sections; and wherein the central section is delimited by two central flanges, and the left and right lateral sections comprising an end flange respectively, wherein the central flanges having a diameter which is larger than the diameter of the end flanges, wherein the central flanges comprising a protrusion or security stop which has the function of limiting the rotation of the feeder, and wherein the end flange only extends in the upper right lateral section **.**

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According to Cottam and Ermerins, (2012)A feeder is provided, in particular for feeding poultry, comprising a polygonal feeding pan defined by a base and a plurality of side walls depending from the base. The side walls define an outer peripheral edge of the feeder having a plurality of substantially straight outer edges. The feeder provides increased feeding space and feed volume with respect to a circular feeder having a radius equal to the apothem of the polygonal feeding pan **.**

According to Linares and Martin, (2010) Poultry behavior is a useful tool in the assessment of the welfare of poultry. A unique challenge of assessing poultry welfare via behavior is that poultry welfare cannot be assessed via behavior alone. The assessment of the welfare of poultry occurs at the confluence of various disciplines such as ethology, ethics, genetics, poultry science, and veterinary medicine. The proper assessment of poultry behavior and welfare requires an interdisciplinary and integrative approach. This article is designed to be an introduction to practical items in the use of behavior in the assessment of the welfare of poultry and to serve as a guiding tool in the pursuit of further knowledge and experience.

According to Linares et al., (2018), reviews practical items for the on-farm assessment of the welfare of individual birds in a poultry flock. While welfare assessment of the flock as a whole is also critical on the farm, in this chapter, we focus on the individual bird. An individual bird's welfare depends on its ability to cope with the social structure, environment, management practices, and health status of the flock. Sickness and injury can impair the individual's ability to cope. It is our responsibility to identify compromised birds promptly and take actions to improve their welfare. Training and experience are keys to identifying and assessing the welfare of sick and injured birds, especially within a large flock.

According to Butterworth (2018), poultry are the most common farmed animals on the terrestrial earth. For example, in 2016, around 55 billion chickens were reared for meat more chickens in 1 year than the estimate for the number of humans who have lived on the planet ever. The history of chicken intensification has been influenced by three factors the movement of people from the country to towns and cities, which also moved poultry production from local to centralized: the rise of the use of electricity to ventilate poultry houses, which allowed large farm buildings to house large flocks of poultry, and the use of fossil fuel to enable feed materials to be to be sourced from around the world and poultry meat to be transported great distances. Approximately 75% of poultry meat today comes from birds reared entirely indoors, and of the 25% not reared under controlled conditions, the majority are farmed locally, or at subsistence level, although with a small percentage of flocks are "returning to the paddock" as people choose to purchase free range or organic poultry.

According to BACUS, ARJIE C.et.al (2018) The growing need for poultry products by consumers has urged the necessity for small and medium scale poultry farmers to meet up the demand since they supply the bulk need of the market especially in the developing countries. There exist the need to produce birds that will meet the market standards within the shortest time without straining the farmer's time, resources and energy. In this project work an effort made to develop a labour or time saving automatically operated automatic feeder that will optimize feeding of birds. There exists many automated equipment's to feed birds in large scale poultries. But it is difficult or not possible to include large scale equipment's in small medium scale poultries. Normally small and medium scale poultries are run by farmers of rural areas. In small scale and medium scale poultries birds are fed with the feeder which requires frequent refilling of food. With a view to facilitate easy and efficient feeding of food to chickens in small and medium scale poultries, it was proposed to design and fabricate a poultry feeder.

According toBersabal et.al (2012), Feed management is maintaining healthy birds, keep fresh feed available at all times. Limit the amount of feed in feeders to the extent necessary to avoid waste. It is a good practice to fill hanging feeders only three-fourths full, and trough feeders only two-thirds full. For efficient feeding, keep the lip of the feeder pan in a hanging tube-type feeder at the level of the bird's backs. Store the feed carefully in a dry, rat- and mouse-proof place, where it will not be subjected to damage from moisture or losses from rodents. A large galvanized garbage can with a tight lid makes an excellent storage container for your feed.

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According to Aydin, A et al., (2016),This research offers a unique monitoring system that uses real-time sound processing technology to accurately detect the short-term feeding behaviours (meal size, meal duration, meals per day, and feeding rate) of grill chickens at the group level. The pecking sounds of ten male 39-day-old broiler chickens were recorded in this study using a microphone mounted to the feeder.

According to SHU-HUI-HUNG (2012),A barrier component is configured through the feed conveying trough in this feeding system. The conveying trough consists of a trough and an above-the-trough fence. The fence is designed with a number of feeding apertures. The barrier member's outer border is near to the inner wall of the trough and the fence. The control device can cause the barrier member to be elevated or lowered within the conveying trough. When the barrier member is not lifted, it can obstruct the feed inside the trough, preventing the poultry from stretching into it to eat, however when the barrier member is lifted to a suitable height, the poultry can stretch from their respective feeding apertures into the trough.

According to Olaniyi O.M, et al., (2016),This paper presents the design of a mobile intelligent poultry feed distribution system that employs the (PSO) adjusted (PID) control technique. The equipment can move about in a controlled setting within a deep litter poultry farm and feeds solid and liquid feed to poultry birds. The system's performance was evaluated in terms of system responsiveness using the criteria Overshoot, Rise time, and settling time. The system's successful testing and performance review revealed that farmers may use it to easily administer both solid and liquid feed to poultry birds with a good return on investment, yield, and profit. Farmers can use the developed mechatronic technology to lessen the high level of human engagement in poultry.

According to ZHC Soh, et al., (2017),The main controller of the chicken feeding system is an Arduino Uno board. There are two key components to this machine: an Arduino that controls the servomotor that moves the food container from storage to the food container, and an Arduino that controls the temperature sensor that determines how fresh the chicken food is. This enhances the coop's atmosphere while lowering labour costs, saving food and chicken feeding on time, controlling the temperature sensor for the food's freshness, and preventing food contamination from insects and chicken excrement.

According to K Sindhuja, et al., (2016),In an effort to increase the precision of environmental variables such as temperature, water level, food feeding, and lowering labour force for industrial domestic poultry farm, this research offers a flexible solution. All management procedures are completed with the aid of an Aurdino ATmega2560 microcontroller, and a (WSN) was used to monitor the critical environmental conditions. This technique can gather, analyse, and present information on a graphical user interface (GUI). Additionally, it enables the user to access the most recent detector data whenever they want using the SMS entrance service and swiftly delivers alarm messages approving user interventions when necessary. Thus, the method decreases the lost work power of farms and minimises the effects of climatic variations brought on by unplanned changes.

According to P Boonraksa, (2022),The design of an autonomous chicken feeder mechanism operated by a smartphone is shown in this study. The ESP-8266 board was used to manage the flow of chicken feed using the DC gear motor. When the conveyor thread reaches the last head of the chicken feed pan, the infrared photoelectric switch sensor cuts off the motor immediately. A timer can be used to switch on and off the chicken feeder. A test run at 100 rpm reveals that the feeder machine can fully feed the hens in 3:45 minutes while utilising 11.20 W of power. The chicken feeders machine can assist poultry producers save time. The feeding time of the chicken feeder can be changed at any time using the smartphone app.

According to M.Ammad-uddin, et.al., (2014),study present a Complete Wireless Network Solution for Poultry Farming (CWNS-PF) in this study to construct an ideal poultry farm with maximum production and economics. This proposed CWNS-PF is beneficial to both types of chicken farms. Our proposed system comprises mostly of seven components that, if followed and handled properly, can improve the quality and quantity of chickens, hence improving human health. According to the proposed method, the wearable wireless sensor node could be a useful tool for early identification

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and epidemics of infected hens. Furthermore, the system (which includes wearable sensor nodes as well as fixed sensor nodes in the shed and soil) would increase overall farm production, quality, and economy.

According to E.M. Reyes. et.al., (2015),This device was created to autonomously feed hens at predetermined intervals and to sound an alarm when feed supplies are running low. Solar panels will be used to collect energy from the sun for this prototype's power needs, which will then be stored in regular automobile batteries. The feeds are going to be kept in a container and dispersed uniformly using a conveyor to the poultry's feeding basin. Because less work will be required and less feed will be wasted, it will be more effective than the traditional manual method of feeding hens. Additionally, the farmers can save energy and money on electricity bills by using the stored power for lighting.

According to S.N.Deshpande,et.al.,(2014),creating an integrated poultry farm. A PLC or microcontroller, actuators, and sensors make up the system's main parts. We provide the farm's operators with data gathered from the sensors. The device can detect changes in environmental parameters and react appropriately to maintain an ideal environment for the chicks' increased health. The poultry farm's production and climatic conditions are improved by the automated system, which is good for the broiler chicks.

According to K.ShekDhauth, et.al., (2020),They created the robot. The robot's primary task is to sort the eggs in the tray by size and maintain the feed. It is an alternative concept for the conveyor belt used to transport eggs in huge poultry forms.

It will be crucial in the small-scale production of eggs from chicken. Large-scale reductions in manual labour and manufacturing rates have been made. The laying of eggs on layer chickens is an issue with loose housing arrangements for laying hens; these eggs need to be manually collected. The collection process should be mechanised because it is laborious and time-consuming. A collection path is necessary for collecting using a robot. For non-uniform repeating area coverage pathways, a novel path planning technique is presented and evaluated using data.

According to P Nabawanuka,(2016),Due to the problem of feed-wastage by chicken farmers, an automated chicken-feeder which operates mechanically, refills the feeding trough whenever feed is consumed by the birds without human supervision has been designed arid its prototype constructed. With this chicken-feeder only small quantity of feed is metered to limit feed-wastage by spillage on the floor with in the poultry farm housing hence, seducing expenditure on the feed. The automatic chicken-feeder components Were designed and fabricated and the assembled-prototype tested for performance. The chicken-feeder can contain up to 25kg per batch of chicken feed which is able to feed twenty-five-layer birds for one week.

According to JH Cai, et.al., (2020),A poultry farm automatic feeder with a digital display, temperature and humidity controls, and a timed feature. It is primarily made up of a feeding mechanism, a travel mechanism, a temperature humidity sensor, and an electrical control box with a digital display that can show 24 hours and a time setting function. When performing automatic feeding with just one intervention, this system lowers labour costs and not only cuts down on staff contact with poultry but also on the spread of disease. With a temperature and humidity sensor, breeding field numerical data can be monitored in real-time, the upper and lower limits of temperature and humidity fluctuations can be set, and spraying water pumps, fans or heating can be controlled according to the set point.

According to Dr. V.A. Narayana, (2022), Automatic Cattle Feeding System is a robotic feeding system which consists of a battery operated robotic vehicle that is capable of feeding an equal amount of feed. All the existing equipment are largely for large scale cattle and poultry farms. But there is no machine for small scale cattle or poultry farms where the human labour is used for feeding the cattle. Our project aims to feed small scale Dairy and Poultry farms as there is no advanced technology that makes things easier for the farmers. Our project can help the farms to cut excess Human labour and also excess strain that affects their body.

According to Chinaeke-Ogbuka, et. al., (2021),This study develops and presents an automated poultry feeding system. The suggested technology simulates the functions of real-life poultry

attendants by delivering feed and water to birds at predetermined intervals. The technology detects the level of feed and water in each trough and intelligently dispenses water and feed based on the detected levels. The current technology can effectively sense and anticipate the level of feed and water in the farm with an accuracy of 98.79% and distribute it in 50-60ms.

According to N.S. Amir, et al., (2016), With the help of sensors and the Internet of Things (IoT) platform, a system called the Smart Chicken Farm Monitoring System has been created to monitor and regulate the environment of a chicken coop. With this technology, poultry breeders may automatically monitor and manage the coop's temperature and humidity using DHT11. By determining the maturity of the broiler chicks in the coop using the load cell sensor, poultry farmers may also determine the weight of the chickens. This technology is thought to be able to assist chicken farmers in keeping an eye on a healthy chicken coop and the development of the grill chicken.

III. PRODUCT DESIGN

The entire model is designed and assembled using Autodesk Fusion 360 software before fabrication.

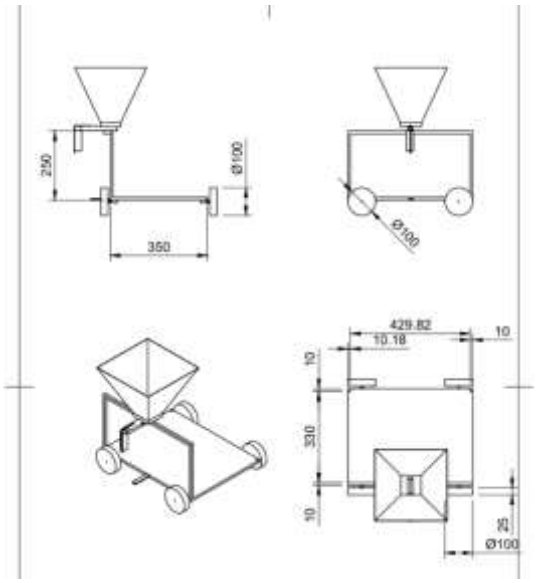

Figure 2: 2D Drawing

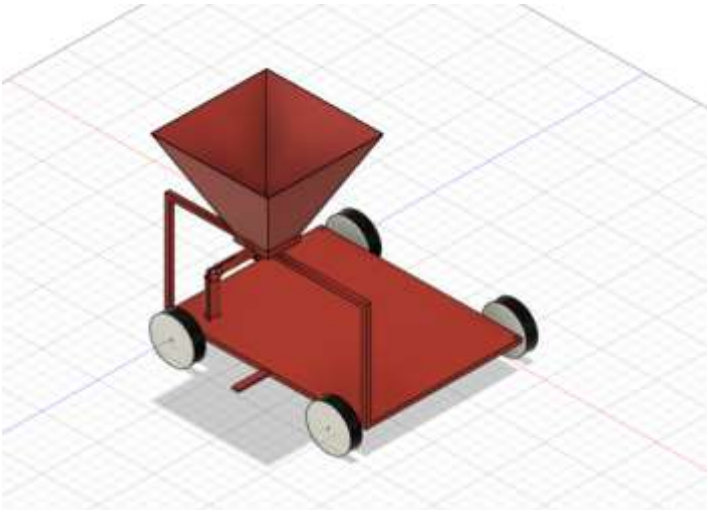

Figure 3: 3D Model

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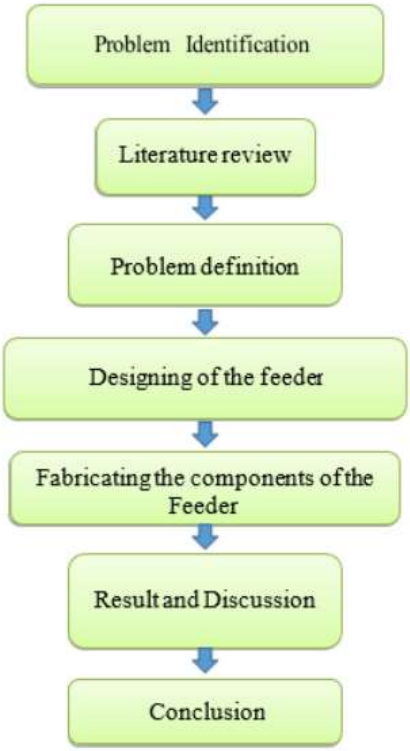
IV. METHODOLOGY



First step is to identify the problem and do a literature survey based on our project. Then design the components of the automatic poultry food feeding system usingautodesk software. Do the required calculations manually, Design the model in Autodesk Fusion 360 and then go ahead with next step. Procure the required components in order to assemble and fabricate the remaining. Assemble and attach all the parts to get the final model. The developed poultry feeder system is completely automated,. The body structure is made of mild steel. The electronic circuitry is consists of an Arduino microcontroller, two (2) units of infrared proximity (IR) sensors, and 2 DC motor and power window motor for gate wall and an electrical buzzer & relay. The robot feeder will follow the line and stop at every intersection to push out feedstuff. During the test, the sensitivity of IR sensor can be adjusted using the potentiometer to test the efficiency of the IR sensors to detect the lines. The IR sensors are connected to the Arduino microcontroller that is powered by a battery. The robot used the input data from IR sensors to detect lines. These data are used to instruct the power window motors to move via the motor drivers. In this work, the feeder system moves using these power window motors that are powered by a battery. Feeder system is attached on top of the machine. It is consists of a feeder tank where feeds are stored. Once perfected, the automatic poultry food feeding system is completely ready.

V. EMBEDDED C PROGRAMMING CODEUSED

```
int in1 = 11;
int in2 = 10;
int in3 = 9;
int in4 = 8;
int lft_ir = 7;
int rgt_ir = 6;
int lft_val;
int rgt_val;
int hopper = 5;
int feeder_detector = 4;
```

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```
int feed_val;
int empty_ir = 3;
int empty_ir_val;
void setup()
{
Serial.begin(9600);
pinMode(in1, OUTPUT);
pinMode(in2, OUTPUT);
pinMode(in3, OUTPUT);
pinMode(in4, OUTPUT);
pinMode(hopper, OUTPUT);
pinMode(empty_ir, INPUT);
pinMode(feeder_detector, INPUT);
pinMode(lft_ir, INPUT);
pinMode(rgt_ir, INPUT);
}
void loop()
{
lft_val = digitalRead(lft_ir);
rgt_val = digitalRead(rgt_ir);

if(lft_val == 0 &&rgt_val == 0)
  {
feed_val = digitalRead(feeder_detector);
if(feed_val == 0)
   {
Serial.println("Feed point detected");
stp();
empty_ir_val = digitalRead(empty_ir);
if(empty_ir_val == 0)
     {
Serial.println("Empty! Hopper On");
digitalWrite(hopper, LOW);
     }
     else
     {
Serial.println("Full hopper Off");
digitalWrite(hopper, HIGH);
fw();
     }
   }
   else
   {
Serial.println("Waiting for feed point");
fw();
   }
  }
  else
  {
stp();
  }
```

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```
delay(250);
}
void lft()
{
digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);
Serial.println("left");
}
void rgt()
{
digitalWrite(in1, LOW);
digitalWrite(in2, HIGH);
digitalWrite(in3, LOW);
digitalWrite(in4, HIGH);
Serial.println("right");
}
void bw()
{
digitalWrite(in1, LOW);
digitalWrite(in2, HIGH);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);
Serial.println("bw");
}
void fw()
{
digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
digitalWrite(in3, LOW);
digitalWrite(in4, HIGH);
Serial.println("fw");
}
void stp()
{
digitalWrite(in1, LOW);
digitalWrite(in2, LOW);
digitalWrite(in3, LOW);
digitalWrite(in4, LOW);
Serial.println("stop");
}
```

VI. TESTING

A 3D-printed auger with a 12 V DC motor attached to one end makes up the feeder mechanism. To force the feed onto meal trays, the motor turns the auger. To evaluate the speed and amount of time required to push the feedstock, a motor driver module and Arduino Uno are both linked to a 12 V DC motor. An IR sensor is used by the poultry feeder system to locate the feeder. The DC motor turns for roughly ten seconds to push the feedstock once the IR detects the feeder, and the process continues until the feeder is fully filled. A second IR sensor then assists in determining the level of feed in the feeder.

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Numerous tests have been performed to demonstrate how well the constructed auger mechanism works to push feedstock out. The experiments also served to confirm how long it takes the motor to rotate the auger for feedstuff output. Experiments have shown that the feeder system successfully pushes feed along the preset intersection lines.

VII. CONCLUSION

Finally, this paper described the design and development of an automatic poultry feeder system that includes an automated feeder mechanism. The performance of the suggested system was tested using actual experiments in this paper. The proposed system takes into account a simple design and system that allows users to engage easily while maintaining a cheap development cost.

In the future, the automatic feeder system will be improved by increasing the number of sensors and using better sensors, such as photoelectric sensors, to improve line detection. Solar power will also be incorporated in future designs to allow for extended periods of operation.Furthermore, this feeder can b improved by incorporating additional applications such as Internet of Things (IoT) and Global System for Mobile Communications (GSM) to alert the user of the feeding process's status.

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