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Automated Aviary Revolutionizing Bird Feeding with IoT Technology

Yadlapalli Sukeerthana [1], Tothadi chandu Kumar[2], Shaik Mothi Baba[3], Chenamraju ManiKanta Varma [4], Prakhya Surya Bharath [5], Vutukuri Leela Satyanarayana [6]

1,2,3,4 Students, and 5,6 Faculty
Dept. of Electronics and Communication Engineering,
PSCMR College of Engineering and Technology, Vijayawada,
Andhra Pradesh, India.
Sukeerthana1695@gmail.com[1] *,tothadichandukumar@gmail.com*[2] *,mothishaik3@gmail.com*[3]
manikantavarmaone8@gmail.com[4] *,surya.prakhya52@gmail.com*[5] *,satya.vutukuri2016@gmail.com* [6]

Abstract: *An automatic feeder for poultry farm with digital display, adjustable temperature and humidity and timing function. It is mainly composed of feeding mechanism, feeding mechanism, travel mechanism, temperature humidity and electrical control box with digital display in the case of a single intervention to perform automatic feeding work, reduces the labour cost, not only can reduce the time of staff contact with poultry, reduce the spread of disease. With a temperature humidity sensor at the same time, the real-time monitoring and display of breeding field numerical, temperature and humidity can be set to allow upper and lower limits of temperature and humidity fluctuations, and according to the set point control spraying water pump, fan, or heating equipment synchronization work, simplifies the operation of separation equipment, precise control of the feeding environment of temperature and humidity value, achieve the goal of the poultry feeding.*
Keywords: *NodeMCU, Solenoid Valve, ESP8266, Water Level Indicator, MG995 Servo Motor*

1. INTRODUCTION:

These are just a few of the consumer products, citizen science, and formal scientific opportunities that exist. Each citizen science survey requires some form of manual, human observation of the birds to enable the feed. The implementation of an automated system to feed birds, collecting data of physical attributes of bird, status of feed level and forward parameters to the end consumer to improve effective feedback system. it greatly increases the efficiency of these systems and could allow for feed to be given in such places that have not been feasible previously, whether due to consumer workloads or un-even time duties.[1] Automatic bird feeder which has a storage capacity for a large quantity of feed so that the feeder can supply feed over a long period of time without attention. The operation of feed system is in such a way that, when the supply of feed at the feeder is exhausting, a conveyor is automatically energized to supply additional quantity. Provision is made to shut off the feed when the supply in the storage container is exhausted. Hence a continuous monitoring of individual birds around the feeder system is necessary and if needed additional attention is recommended to specific birds who are on the verge of food lapses. The existing high-cost video surveillance system has capability to detect birds via markers, but requires additional sensory information or high focus camera to calibrate food intake. The proposed system design demonstrates selective monitoring of birds and approximately quantifies the food intake by the individuals in a group of the rehabilitation. [2] Poultry farming is an economic activity that consists of raising birds such as chickens, ducks, turkeys, and geese to obtain meat and/or obtain eggs for human consumption. However, the conventional poultry rearing system employs traditional free-range rearing; that is, poultry are raised outdoors; therefore, they roam freely during the day. [3] Beyond its

immediate practical benefits, the IoT-based Automatic Bird Feed System holds promise for broader applications in avian research, conservation, and education. By capturing and analyzing data on feeding habits, species preferences, and environmental interactions, researchers can gain valuable insights into avian behavior and ecology.

2. LITERATURE SURVEY:

In 2022 christopher Gerhardon and Cheol-Hong Min [1] ”IOT Wireless Sensor Network for Bird Feeder Monitoring .”There are over 10,000 bird species in the world, with over 900 species documented in North America. Considering the population size of some of these species, the task of monitoring sightings, flock health, and population estimates are considerable for a single scientist, much less a team of scientists. Citizen science projects are common within the world of bird watching and some of the burdens on scientists. In 2022 C K Vinay, Praveen Kallam, Jayanthi Kallam, Madhav Rao [2], ”Towards Effective Rehabilitation”. Veterinarians typically investigate bird rehabilitation, and not much technology intervention has been tried to address the recovery period of birds in groups up to this point. Typically, several breeds of birds are gathered in a small area and given care until they recover. A bespoke array of coils constituting an RFID system to identify and localize birds inside the feeder system, as well as an array of weight sensors interfaced to a microprocessor to measure food intake, are features of this sturdy and reasonably priced feeder design. In 2022 Yadhira S. Valenzuela-Lino, Jesus Eduardo Rosales Fierro, Jhon Rodrigo Ortiz -Zacarias Nabilt moggiano, Carlos Albert Coaquira-Rojo, Deyby huaman-chahua [3], “Automated Feeding and Drinking System for Turkeys in Different Stages of Development” This research shows the design of an automated food and beverage system for turkeys at different phases of growth. The poultry business has automated its procedures to maximize the breeding time of birds.

In 2016 K. Sinduja, S. Sofia Jenifer, M. Sri Abhishek, B. Sivasankari [4]. “Automated control system for poultry Farm Based on Embedded system”. Presently, farmers physically and sporadically check the farm’s environmental conditions, which is generally in line with their labor-intensive and time-consuming skills. The temperature during brooding is the biggest drawback in a chicken farm. A hatching chick is unable to regulate its body temperature.

In 2018 Ruben Del-Rio-Ruiz, Juan-Manuel-Lopez Garde, Jonathan-Ruiz-De-Garibay, Jon Legarda Macon [5]. “Smart Nests: IOT for Ornithology” The IoT bird nests have consistently been detected in manual and field tests, with success rates of 100 and 95 percentage, respectively. With the only adjustment of the coil antenna diameter based on the size of the bird, this Internet of Things gadget might be utilized for any other kind of bird.

In 2017 Zainal H.C. Soh, Mohd H. Ismail, Firzana, H. Otthaman, Muhamad K. Safie, Muhamada. A. Zukri, Syahrul A.C. Abdullah [6],” Development of automatic chicken feeder using Arduino UNO” thus, the creation of an automated chicken feeding system could prove to be highly beneficial for the expansion of the poultry sector. This device can feed chickens in place of a worker, solving the labor shortage in the sector and bringing in a semi-automated procedure for the poultry business. The main controller of the chicken feeding system is an Arduino Uno board. This machine consists of two main parts: an Arduino to control the servomotor that moves the food container from storage to the food, and another Arduino to regulate the temperature sensor that determines how fresh the chicken food is. This lowers labor costs, saves food, and ensures that the chickens are fed on schedule while also improving the coop’s environment. In 2013 V.I.Umogbai [7]”Development of a Mechanical family poultry feeder” It is necessary to raise birds that will satisfy consumer demands in the shortest amount of time while sparing farmers’ time, money, and effort. The goal of this research was to develop a labor-and time-saving mechanically operated automatic feeder that would maximize bird feeding in small (or) medium sized family poultry farms. In 2021 Eldhose Kurian, Jerin joshy, Rohit Augustine [8] “Semi-Automatic Poultry Farm Feeding Machine” in contemporary industry, screw conveyors are frequently used to transfer semi-solid materials efficiently. These items include food waste, wood chips, aggregates, cereal grains, animal feed, boiler ash, meat and bone meal, municipal solid trash, and many more. They can also be employed horizontally or slightly inclined. The market is filled with readily available screw

conveyors. However, these are not appropriate for small-scale companies and are meant for large-scale material handling applications. In 2016 Mahale, Rupali B, Sonavane S. S [9]" Smart Poultry Farm Monitoring Using IOT and Wireless Sensor". The world's agricultural produce report states that chicken is the most popular produce due to its high protein content, low fat and cholesterol content, and lower energy content compared to other poultry varieties. The safety of food products, such as chickens, has come under heightened scrutiny in recent days all across the world, and there has been a surge in demand for high-quality chicken food. This study focuses on the technology-based approach to the economical, asset-saving, quality-focused, and efficient management of chicken framing. In 2016 Lata S. Handigolkar, M.L. Kavya, P.D. Veena,[10] "IoT Based Smart Poultry Farming using Commodity Hardware and Software" Farmers found the framework to be very helpful because it made it simple for them to access and control the system remotely with their portable mobile devices. The technology boosts chicken output, minimizes the need for human intervention, saves time, and maximizes resource use.

3. METHODOLOGY:

In this project, we used the ultrasonic sensor, Water level sensor, node MCU, Servo motor, Relays. node MCU is an open-source firmware and development kit that helps in building Internet of Things (IoT) projects quickly and easily. It is based on the ESP8266 Wi-Fi module and uses the Lua scripting language. The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Espressif Systems.

As a shown fig.1 The TCP/IP model, also known as the Internet protocol suite, is a conceptual framework used for communication over the internet. It stands for Transmission Control Protocol/Internet Protocol. The TCP/IP model consists of four layers, each responsible for different aspects of network communication.

The system is equipped with motion sensors or other types of sensors, such as infrared or weight sensors, placed strategically around the feeder. These sensors detect the presence of birds or their movement in the vicinity of the feeder. When a sensor detects bird activity, it sends a signal to the control unit of the feeder, triggering the dispensing mechanism.

This mechanism can vary depending on the design of the feeder and may include mechanisms like motorized feed dispensers or gravity-fed chutes. Upon receiving the signal from the sensor, the dispensing mechanism releases an appropriate amount of bird food into the feeding tray or onto a designated feeding area. The amount of food dispensed can be pre-set or adjusted based on the specific requirements of the feeder. The automatic bird feed system often includes programmable settings that allow users to customize feeding schedules, portion sizes, and other parameters.

This flexibility enables users to tailor the system to meet the dietary needs of different bird species and environmental conditions. The system is typically powered by batteries or can be connected to an external power source. Ensuring a reliable power supply is essential for the continuous operation of the automatic bird feed system. Users monitor the system periodically to ensure proper functioning, replenish bird food cleaning the feeder and checking for any technical issues.

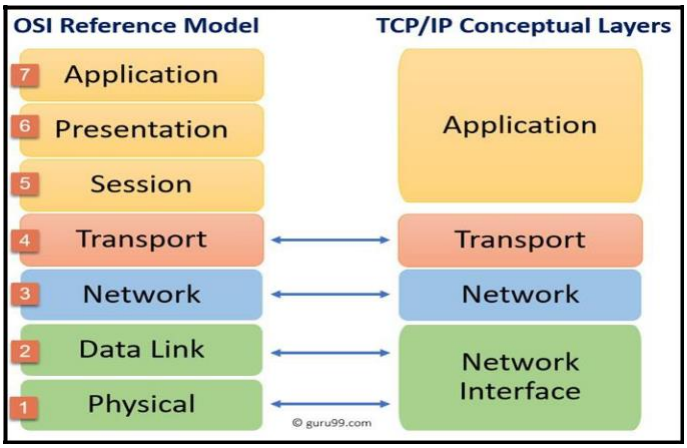

Fig. 1. TCP Model Layers

As a Shown fig.2 In this project, we used the mercury ultrasonic sensor, soil moisture sensor, NodeMCU ESP8266, servo motor MG995, relays. The system is equipped with motion sensors or other types of sensors, such as infrared or weight sensors, placed strategically around the feeder. These sensors detect the presence of birds or their movement in the vicinity of the feeder. When a sensor detects bird activity, it sends a signal to the control unit of the feeder, triggering the dispensing mechanism. This mechanism can vary depending on the design of the feeder and may include mechanisms like motorized feed dispensers or gravity-fed chutes.

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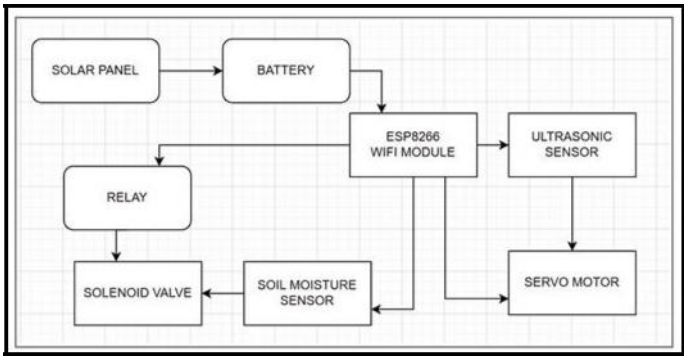

Fig. 2. Diagram Showing operation of Bird feed system

As a Shown in the figure below various parameters and features of ESP8266 based node MCU. **3.1 Hardware:** Node MCU is based on the ESP8266 microcontroller, which features integrated Wi-Fi capabilities. It usually comes in a development board form factor with on-board USB programming and power supply.

3.2 Lua Scripting: NodeMCU firmware provides an environment for developing firmware using Lua scripting language, which is easy to learn and use. Lua scripts can be uploaded and

executed directly on the Node MCU module.

3.3 Versatility: NodeMCU can be used for a wide range of projects including home automation, remote monitoring, data logging, and IoT prototypes due to its versatility and ease of use.

3.4 IoT Applications: Node MCU is widely used for developing IoT applications due to its low cost, small size, and built-in Wi-Fi connectivity. It can be used to connect various sensors, actuators, and other devices to the internet and create smart and connected systems.

3.5 Development Environment: Node MCU can be programmed using various integrated development environments (IDEs) such as Lua-Loader, ESP-loader, and NodeMCU Flasher. Additionally, it can also be programmed using the Arduino IDE with the help of additional board manager URLs and libraries.

3.6. Community Support: NodeMCU has a large and active community of developers and enthusiasts who contribute libraries, tutorials, and resources to help others in building projects using NodeMCU.

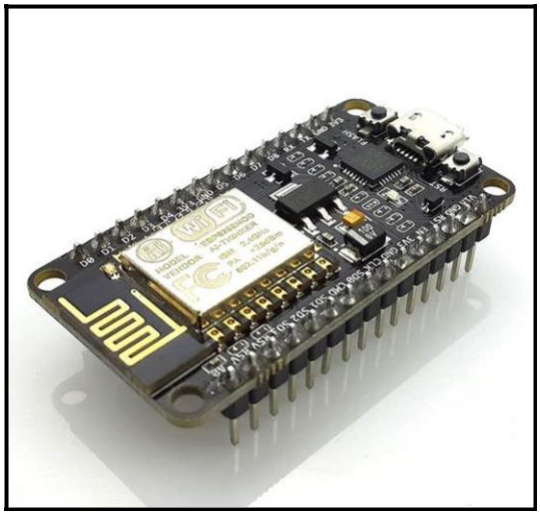

Fig.3. Node MCU

As shown in fig.4 A water level indicator is a basic electronic gadget that measures and shows the water level in a reservoir or container. It is frequently used to monitor and regulate water levels in residential, commercial, agricultural, and environmental applications. When the water level rises and touches the sensor probes, it completes an electrical circuit between the probes and the control unit. The control unit detects the completed circuit and activates the corresponding indicator, usually an LED or a segment on a display, indicating the water level. Different configurations of sensor probes and control units can be used to indicate multiple levels of water or to trigger alarms or control systems at specific levels.

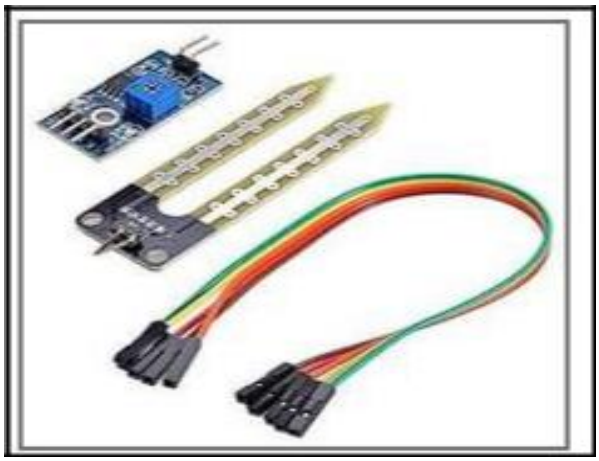

Fig.4. Water Level Indicator

As shown in fig.5 an ultrasonic sensor is a tool that uses ultrasonic sound waves to estimate an object's distance by detecting the echo that is reflected back. Common uses for these sensors include robotics, automation, security systems, and distance measurement. There are two primary categories of ultrasonic sensors.

The ultrasonic wave transmission and reception are accomplished by independent components in these sensors. They release a short burst of ultrasonic waves, then wait for the echo to appear. They determine the object's distance from them by timing the echo's return. These sensors transmit and receive ultrasonic waves using a single transducer. After releasing a short burst of ultrasonic waves, they move into reception mode and wait for the echo. They estimate the distance based on the echo's return time, much like in transmitter-receiver systems.

Fig.5.Ultrasonic Sensor

A solenoid valve is an electromechanically operated valve used to control the flow of liquid or gas. Here's a breakdown of its key components and functionality:

Key Components:

1. **Solenoid**: This is an electromagnetic coil that gets energized when an electric current passes through it.
2. **Plunger or Piston**: A movable part within the solenoid that responds to the magnetic field generated by the solenoid. It is often made of ferromagnetic material.
3. **Valve Body**: The casing that houses the solenoid and the plunger, along with the inlet and outlet ports for the fluid or gas.
4. **Orifice**: The opening through which the fluid or gas flows. It is controlled by the plunger.
5. **Spring**: A spring mechanism that helps return the plunger to its original position when the solenoid is de-energized.

Working procedure of solenoid valve:

1. **De-energized State**: In its resting state, the solenoid is not energized, and the spring holds the plunger in a position that either opens or closes the valve, depending on the type of valve (normally open or normally closed).
2. **Energized State**: When an electric current passes through the solenoid, it generates a magnetic field. This magnetic field pulls the plunger towards the center of the solenoid, overcoming the spring force. The movement of the plunger either opens or closes the orifice, thus controlling the flow of the fluid or gas.

Types of Solenoid Valves:

1. **Direct-Acting Solenoid Valves**: The plunger directly opens or closes the orifice.
2. **Pilot-Operated Solenoid Valves**: These use the fluid pressure to assist in opening or closing the main valve orifice. They are more suitable for higher flow rates and pressures.

Fig.6.Solenoid Valve

As shown in fig.7 30-cm cable and a 3-pin female header connector (’S’ type) that fits most Futaba, JR, GWS, Cirrus, Blue Bird, Blue Arrow, Corona, Berg, Spectrum, and Height receivers are included with the unit. About 120 degrees can be rotated by this high-speed standard servo (60 degrees in each direction).

Since it will fit in small spaces, it’s ideal for beginners who want to make things move without developing a motor controller with feedback and gear box. You may use any servo code, hardware, or library to drive these servos. To help you set up quickly, the MG995 Metal Gear Servo also includes a variety of arms and components! In this instance, the red wire is linked to regulated +5V power, which may supply orange wire is connected to a microcontroller’s PWM (Pulse Width Modulation) output, whereas Brown wire is grounded and may carry current up to 1 amp. If the servo and microcontroller in the circuit have separate power sources, then the servo ground and microcontroller ground must be connected.

Fig.7. MG995 Servo Motor

4.RESULTS AND DISCUSSIONS

An advanced bird feed mechanism pushes the feed data to html web-page based server which facilitate user to monitor water level status of feed system in percentage to understand the frequency of water utilization, solenoid valve status, bird distance from sensor to provide feed to bird.

Fig.8. Feeding Data

Fig.9. Server IP address

Fig.10. Bird Feed System operational View

Presence Sensors: Detect the presence of birds near the feeding area. Measure ambient light conditions, helping control feeding times.

Environmental Sensors: Monitor factors like temperature or humidity for context-aware adjustment. In essence, the automatic bird feed system uses sensors to gather information, a control unit to process that information, and a feeding mechanism to dispense food accordingly. This automation reduces the manual effort required for regular bird feeding and ensures a more consistent and efficient feeding routine.

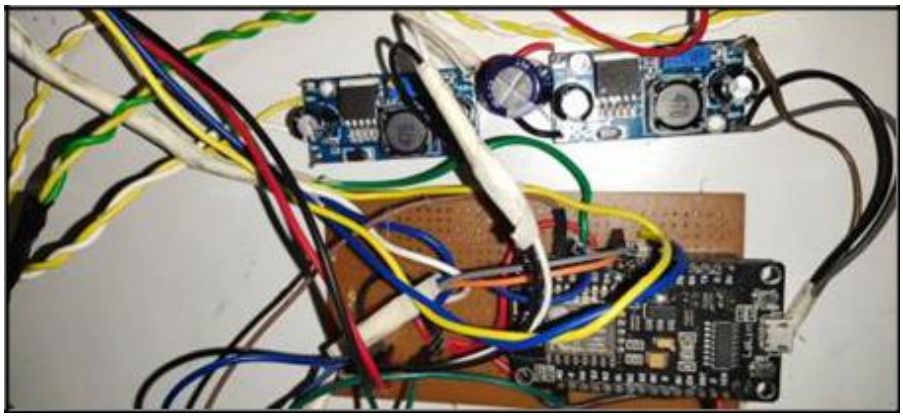

Fig.11. Internal Design of Bird Feed System

5.CONCLUSION

An automatic bird feed system offers convenience and efficiency in ensuring a regular and timely supply of feed to birds. By automating the feeding process, it not only saves time for poultry but also promotes consistent nutrition to maintain bird health. Additionally, such systems can contribute to the well-being of birds by preventing food shortages and fostering a healthier environment. The final output in an automatic bird feed system is the controlled and scheduled dispensing of bird food based on various factors such as time**,** bird features, quantity of feed to specific bird, sensor inputs, or programmed parameters. This results in a consistent and reliable feeding process for birds, promoting their well-being and alleviating the manual effort required for regular feeding. The system's ultimate goal is to provide an automated solution that ensures birds receive appropriate nutrition while offering convenience to those responsible for their care.

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