IOT BASED FISH FEEDER SYSTEM

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***Abstract*— People have always enjoyed having pets around them, but in today's hectic world, it might be difficult to properly care for pets, particularly fish, which require more attention. When fish owners are out of town, their fish may be left with a feed shortfall or over-feed. Another consideration is the water quality (temperature, PH level, and so on). As a result, a solution is provided in this article to address the aforementioned issues. Two components comprise the proposed system. The first is for fish eating, while the second is for water feature and level monitoring. The first module also includes electrical, automatic, and communication parts that are connected to the Internet of Things (IoT) to allow fish to be fed on a schedule or remotely through a web interface. Microcontrollers with PH, Ammonia, Temperature and other sensors are included in the second module, which is used to monitor the aquarium's environment.**

Keywords— PH Sensors, IoT, Scheduled feed, Remote feed, Micro-controllers

INTRODUCTION

Every single person in world of today is engaged in a hectic routine and involved in their work/professions. Pets, such as cats and dogs, are an asset of solace and ease for some people, and they like spending time with them when they have free time. The most famous of these pets is fish. Fish owners, on the other hand, may find it difficult to assume responsibility for their fish or to feed them on a constant basis. Many fish breeders have the problem of their fish being left by a feed decrement or surplus feed while they are at work or out of city. There are numerous auto-feeding technologies available to assist owners to deal with feeding issues, their functionality is limited. These instruments can be used with pre-set feeding models given by a veterinarian or as part of a fish owner's schedule.

The issue here is that fish required to be eaten at the proper time and with the proper quantity of eat, yet auto feeders often feed at a set time and with the same amount of feed because they work on pre-set feeding patterns. It's also important to keep an eye on the fish tank's water level and condition. It's also necessary to maintain track of the status of fish from afar . As a result, the proposed model has addressed all of these issues by incorporating IoT concepts into the automated care of pet fish. It is easier to take good care of pet fishes when the proposed model is used, and their life limit is enhanced, though the fish holder is engaged at task or out of city for some time.

LITERATURE SURVEY

Smart Fish Feeder and Monitoring System

• The project focuses on the development of a smart Internet of Medical Things (IoMT) based system. It is centered around coming up with constructive insights that will mainly support the monitoring framework and different IoT integration strategies, emphasizing want this to be used in a COVID-19 scenario.

Water Quality and Fish Feeding Real-Time Monitoring Via IoT

• It presented the problems of the conventional fish farming method and also included an IoT-based monitoring and control system for fish food feeding. The aim of this is real-time water quality and feeding cycle monitoring to minimize human intervention.

IoT-Based Automated Fish Feeder

•IoT is used for automation feeding of fish, which is focused on the productivity and efficiency of operations. It also expounds on the importance of accurate feeding and environmental sustainability.

Improved IoT-Based Aquaculture Monitoring System and Fish Feeder

•It introduces a prototype shed to be an improvement in fishfarming performance with greater efficiency-integrating advanced sensors for absolute feeding and monitoring of water conditions, leading to much better results in aquaculture. **Sensor-Deriven Monitoring for Aquaponics**

-The systems interface with online monitoring to help manage and monitor light, humidity, and water level through sensors. It offers support on the integration in terms of challenges met with information of technical relevance to the promising future of integrated aquaponics.

An IoT- Based Water Quality Monitoring System

•It uses sensors to gauge the pH, dissolved oxygen, temperature, and water levels. It shows how an IoT solution has ensured water quality, which is a precursor to fish health.

OBJECTIVE OF PROJECT

The primary objectives of an IoT-based fish feeder and monitoring system.Automated feeding helps guarantee that constant and sufficient feed is provided to fishes at set times. It thus eliminates this need for manual feeding, hence labor cost in addition to human errors. In addition, this technique will help to avoid overfeeding or underfeeding, which may lead to disease effects on fishes while causing poor water quality.

SCOPE OF PROJECT

The main focus of an IoT-based fish feeding and monitoring system would be on automating and optimizing aq uaculture practices using IoT technologies. It would thus enable real-time monitoring and control of various environmental and operational parameters that would increase the efficiency, reliability, and sustainability of fish farming.

DRAWBACKS OF EXISTING SYSTEM

Connectivity Issues: Remote farms or aquariums may face issues with connectivity, affecting the reliability of cloud-based systems.

Data Overload: Continuous data collection can lead to an overwhelming amount of data, making it challenging to analyze and interpret effectively without proper tools.

PROPOSED SYSTEM

The proposed low-cost IoT-based fish feeding and monitoring system focuses on providing an affordable, easyto-maintain solution for small-scale fish farms and aquariums. Key components include:

Automated Fish Feeder: A simple, programmable feeder controlled by a microcontroller (Arduino/Raspberry Pi/esp32), dispensing food at present times or based on sensor data.

Environmental Sensors: Low-cost sensors to monitor water temperature, pH, and dissolved oxygen levels. Centralized Control Platform: A microcontroller that collects sensor data, controls the feeder, and sends alerts for any parameter anomalies.

Cloud/Local Data Storage: Data is logged on a cloud platform (e.g., ThingSpeak) or locally, accessible remotely for monitoring.

Sustainability: Option for solar power to make the system energy-efficient and suitable for off-grid areas. The system offers low initial cost, minimal maintenance, easy setup, and remote monitoring, making it ideal for smallscale aquaculture while ensuring fish health and efficient feeding.

SYSTEM DESIGN

1. Sensor Integration

To ensure optimal conditions for aquatic life, the system uses a range of sensors:

-**Water Quality Sensors**: This encompasses pH sensors for checking the acidity, temperature sensors for proper thermal conditions, and dissolved oxygen sensors to measure oxygen levels. These parameters should be maintained within the optimal range to keep the fish healthy.

2. Automated Feeding Mechanism

The feeding system is designed to dispense food at scheduled intervals or in response to specific triggers: - **Motorized Feeders**: Servo motors control the release of fish feed, allowing precise regulation of feeding times and quantities. This automation reduces manual intervention and ensures consistent feeding schedules.

- **Feed Storage**: The feeder is built with layers, with each layer having a hole that allows for regulated feed distribution. This design will ensure that the feed supply is adequate and minimal waste is created.

3. Data Processing and Connectivity

At the heart of the system lies the processing and transmission of sensor data:

- **Microcontrollers:** The Arduino Mega 2560 processes the data from several sensors and runs actuator control signals for feeders and water pumps.

Wireless Communication Modules, such as ESP32 allow data transmission to cloud services allowing remote monitoring through internet-connected devices.

4. User Interface and Control

It is an interactive interface through which the fish farmers can communicate with the system **- Mobile Applications:** Applications offer real-time data visualization and control options, allowing users to adjust feeding schedules and monitor water quality remotely. **- Cloud Integration:** The data collected by sensors is stored and analyzed in the cloud, enabling advanced analytics and historical data review to support management decisions. **5. System Design and Development**

The development process includes several key steps:

- Component Selection:

- Choosing the right sensors, microcontrollers, and communication modules according to the specific requirements and environmental conditions. **Integration and Testing:** Assembling components and testing them to ensure that they work properly under different scenarios.

ARCHITECTURE

1.Microcontroller:

A central point in the system is the microcontroller, which in this case can be an ESP32 that will collect data from sensors and activate actuators. This ESP32 module is preferred due to its integration of Wi-Fi and Bluetooth for smooth communication between the system and other devices and even the internet.

2.Sensors:

- Water Quality Sensors: This is comprising pH, temperature, and turbidity sensors measuring continuously to assure water quality ranges optimal for healthy fish conditions.

Ultrasonic sensors. Ultrasonic sensors record fish movement activities as a parameter for their activity level or level of feed and feed-related feeding response behaviors in the water body under investigation.

3. **Automated Feeding Mechanism**.

The feeding system generally consists of a feed storage unit and a dispensing mechanism controlled by the microcontroller. For example, a servo motor can be used to operate the feeder, which will release precise amounts of feed at scheduled times or when it detects fish activity.

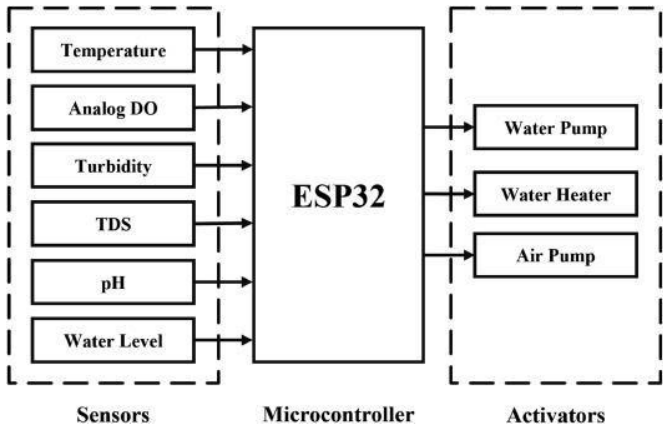
4. **Communication Module**

Modules such as ESP32 combined with SIM800L facilitate the system's connectivity by allowing data to be transmitted over Wi-Fi or cellular networks. This would allow real-time monitoring and control through mobile applications or web dashboards, making it flexible and easily accessible for fish farmers.

5. **Software Interface**

The user-friendly interface will be included as an integrated system using an application like the Blynk app, enabling a user to see sensor data, change feeding schedules, and obtain alerts. Communication with the microcontroller provides for a smooth experience for a user to remotely control the aquaculture environment using the application.

6. **Data Analytics and Automation** For these data, further advanced algorithms of processing optimize times and quantities during feeding, limiting waste and adjusting optimal growth. For instance, by analyzing a pattern of detected activities of fish utilizing ultrasonic sensors, the whole system can further adjust feeding to be dynamic.
7. **Remote Monitoring and Controlling**: The integration of IoT allows fish farmers to get realtime updates and control the system from anywhere. Alerts can be set up for parameters falling outside optimal ranges, allowing for prompt corrective actions. **8. System Maintenance and Scalability** The modular design of the system is efficient for easy maintenance and scalability. More sensors or be added when required. The use of standard communication protocols also ensures it is compatible with otherdevice sand platform



WORKFLOW

Data Acquisition:

Sensors continually measure the data on water temperature, pH level, water level, and ammonia concentration.

The microcontroller scans the sensor input periodically.

Data Processing and Decision Making:

The microcontroller calculates sensor data to find whether any of the parameters fall outside the ideal range.

Based on set threshold limits, the system makes decisions regarding whether or not to switch the actuators, for instance, if the water is cold enough, to switch the heater.

Feeding Schedule Management:

It is possible to set up feeding time and amount, which can be configured from a web interface.

The automatic feeder delivers the proper amount of food at the appointed time.

Remote Monitoring and Control:

Sensor data are transmitted to a cloud platform for real-time monitoring via a web or mobile application.

Users can change settings, including feeding schedules or temperature setpoints, from a remote location.

Alerts and Notifications:

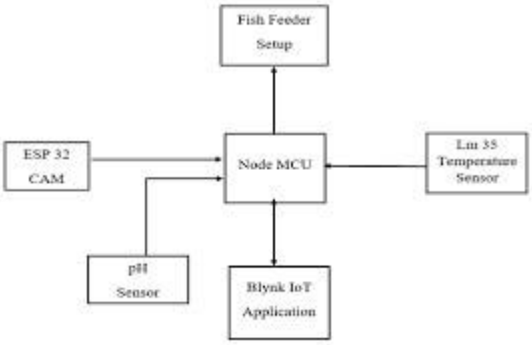
It sends alerts outside the safe ranges of parameters for prompt correctiveactions..

METHODOLOGY

The steps involved in the operation of the system are:

Sensors are in continuous monitoring of the water quality parameters.: The central control unit is used to process the collected data for assessing the quality of water and optimum feeding times. Based on the analysis, the automated feeder dispenses the right amount of food at the scheduled times. The system will alert the farmer about any anomaly or required interventions through the user interface.

SEQUENCE DIAGRAM:



ACTIVITY DIAGRAM:

Initialization: Power on the system.Initialize sensors and actuators.Establish communication with the central server or user interface.

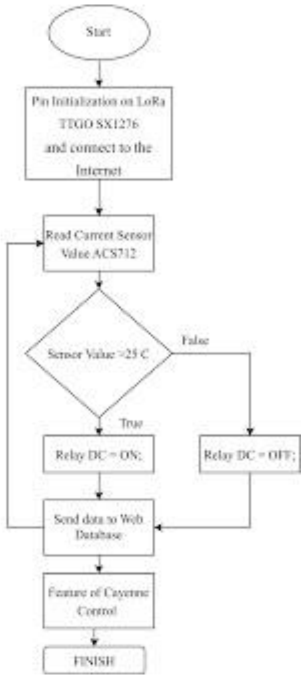
Data Collection: Sensors continuously monitor water quality parameters.Data is transmitted to the microcontroller.

Data Processing: Microcontroller processes sensor data to assess water quality.Compare current parameters with predefined thresholds. **Decision Making:**If water quality is within acceptable ranges, proceed to the next step.If water quality deviates from acceptable ranges, trigger alerts and recommend corrective actions**.** **Feeding Schedule Check:**Retrieve feeding schedule from the user interface or predefined settings.Determine if it's time to dispense feed**.**

Feed Dispensing: Activate actuators to dispense the appropriate amount of feed.Monitor feed dispensing to ensure accuracy**. Data Transmission:**Transmit updated water quality data and feeding status to the central server or user interface**.**

User Interaction: Users receive real-time updates and alerts.Users can adjust settings, such as feeding schedules or water quality thresholds, via the user interface.

System Monitoring: Continuously monitor system performance and health.Log data for historical analysis and reporting.



IMPLEMENTATION:

Microcontroller: The ESP32 microcontroller is appropriate because it already has Wi-Fi built in, and it provides multiple input/output pins, which enable easy connection with sensors and actuators. **Temperature Sensor**: Monitors the water temperature to ensure it stays within an optimal range to keep the fish healthy.

pH Sensor: Measures the acidic or alkaline nature of water, which ensures that the condition is suitable for the fish.

.**Servo Motor**: Controls the fish feeder mechanism, dispensing food at scheduled times.

It means this microcontroller with ESP32 sends sensor data towards the processing and makes decisions related to defined limits.Communication This microcontroller gets in touch through a cloud based application like an "app Blynk" towards relaying sensor information and receive commands from its user.The system acts like an activator, using knowledge of sensor inputs, for variations in feeding regimes, water condition, and content.Programming Environment is Arduino Integrated development environment used with ESP32 on the micro-controller. Install calibration routines on each sensor so that readings become accurate.Develop an algorithm to accomplish the following.Schedule feeding at best times.Set up water temperature between specific ranges.Adjust pH by changing the water. Report abnormal conditions using the cloud interface. Platform Selection: Select a service like Blynk for remote access and control capabilities. Set up dashboards showing trends of the sensor data to help users determine the status of the aquarium.

Enable users to change feeding times and conduct water changes from a distance on the cloud server.Provide a secure power supply for uninterrupted operation.Provide battery backup systems so the system can continue running in case of power outages.

Wiring and Connections:

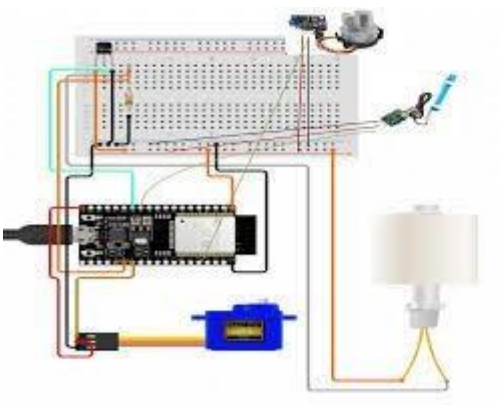
Servo Motor Connection: Connect IN1, IN2, IN3, and IN4 stepper motor driver pins to GPIO pins 27, 26, 25, and 33 of the ESP32, respectively.The motor driver must be connected to a power source appropriately. For this, VIN of the ESP32 is connected to VCC, and GND is connected to GND.

Temperature Sensor (DS18B20):

The data pin of the temperature sensor is connected to GPIO 4 on the ESP32.A 4.7kΩ pull-up resistor between the data line and VCC will ensure the communication is okay. **pH Sensors:**

The analog output of the pH sensor should be connected to GPIO 34 (ADC1) on the ESP32.

Use jumper wires and a breadboard to connect the hardware components to the esp32



Deployment and Maintenance

Installation: Position the assembled system in such a location that there is the least exposure to direct sunlight during harsh weather conditions if it uses solar power to operate

Maintenance: Check on the sensors periodically and ensure that the feeding system is cleaned free of potential blockages. The connections must be checked for signs of wear or corrosion. The firmware should be upgraded to include any improvements or updates in security patches.

RESULT

The performance and functionality of the system should be presented based on the experiment or implementation. The results can include the accuracy of the sensors used such as the temperature and pH sensors, and the reliability of the automatic fish feeder in terms of feeding frequency and the amount of food dispensed. The system's response time to user commands via the mobile application can also be discussed in this section. The findings from the results should be analyzed, and the strengths and weaknesses of the system should be evaluated. For instance, the accuracy and reliability of the sensors used in the system can be compared with those of other sensors available in the market. The response time of the system can be discussed in terms of the impact it has on the fish and how to optimize the system's response time to avoid overfeeding or underfeeding the fish. Furthermore, the potential impact of the system on the environment can be evaluated, particularly in terms of reducing food wastage and the overall impact on the fish's health and growth. Overall, the IoT based automatic fish feeder with mobile application should provide a comprehensive analysis of the system's performance and potential impact, along with potential areas of improvement for future research.

FUTURE SCOPE

1. Advanced Sensor Integration

Future IoT-based fish feeder systems are expected to incorporate a broader range of sensors to monitor additional environmental parameters. Beyond basic metrics like temperature and pH, sensors for dissolved oxygen, salinity, and ammonia levels can provide a more comprehensive understanding of water quality, leading to improved fish health and growth.

2. **Machine Learning and Predictive Analytics** The use of machine learning algorithms can allow aquaculture to make proper predications. In this, historical as well as real-time data can be used for analysis to predict

5 the right time and amount of feeding; it can identify early warning signs of disease and take pre-emptive control over environmental parameters. Such smart decision support systems can make

3. Integration with Blockchain Technology

It is, therefore, clear that the aquaculture supply chain can be traceable and more transparent through implementing blockchain. Because data are kept on a decentralized ledger, ensuring the integrity of information about health, feeding habits, and environmental conditions of fish could be beneficial both to consumers and regulatory bodies.

4. Remote Monitoring and Management

The future scope includes the development of more sophisticated remote monitoring systems, allowing fish farmers to oversee operations from anywhere. Utilizing mobile applications and cloud-based platforms, farmers can receive real-time alerts and control system parameters, facilitating timely interventions and reducing labor costs.

5. Scalability and Interoperability

Future systems will likely focus on scalability to accommodate various sizes of aquaculture operations, from small-scale farms to large commercial enterprises. Ensuring interoperability with existing infrastructure and other technological solutions will be crucial for seamless integration and widespread adoption.

ADVANTAGES:

Easy monitoring: With the mobile application, users can easily monitor and control the fish feeding process, ensuring that the fish are fed on time and the right amount of food is dispensed.

Automatic feeding: The system is designed to automatically feed the fish based on predefined feeding schedules, which helps to ensure that the fish are fed regularly and reduces the chances of over or underfeeding

Accurate feeding: The system uses sensors to measure the temperature and pH level of the water, which helps to ensure that the fish are fed the right amount of food that matches the current environmental conditions.

Cost-effective: The system is designed using cost-effective components such as Node MCU, ESP 32 CAM, and pH sensors, making it a more affordable solution compared to some other automated fish feeding systems.

Easy to use: The Blynk IoT application provides an easyto-use interface for controlling and monitoring the system, making it accessible to users of all technical backgrounds.

Improves fish health: By providing regular and accurate feeding, the proposed system helps to ensure that the fish are healthy and well-fed, which can result in improved growth rates and overall health.

REFERENCES

[1] Uray Muhammad Rifki Herdian; Hilal H. Nuha; Rio Guntur Utomo,‖ Smart Fish Feeder Design and Analysis at Sekemala Integrated Farming (Seinfarm)‖, 2nd International Conference on Intelligent Cybernetics Technology & Applications (ICICyTA), Electronic ISBN:979-8-3503-9913-4,2022. [2] Emmanuel Gbenga Dada, Nnoli Chukwukelu Theophine, Adebimpe Lateef Adekunle ―Arduino UNO Microcontroller Based Automatic Fish Feeder‖, The Pacific Journal of Science and Technology, Volume 19. Number 1, pp. 168-174 ,May 2018. [3] Hidayatul Nur Binti Hasim, Mritha Ramalingam, Ferda Ernawan, Puviarasi R.―Developing fish feeder system using Raspberry Pi‖, IEEE 3rd International Conference on Advances in Electrical, Electronics, Information, Communication and BioInformatics (AEEICB17), pp.no: 246 – 250,2017 [4] K. Krishna Kishore ; P. Vamsi Krishna ; D. Srikanth,―An Automatic Fish Feeding for Aquaculture‖, Third International Conference on Sensing, Signal Processing and Security (ICSSS),2017 [5] p. 012041, 2017. [6] Scientific Research in Computer Science, Engineering and Information Technology, Volume 2 | Issue 2 | ISSN : 2456-3307, pp.111-115,2017. [7] Mohd Nor Azni, M.N.H,Vellasami. L, Zianal. A.H, Mohammed.F.A, Mohd Daud.N.N, Vejasegaran.R, N.W.Basharudin, Jusoh.M, Ku Azir.N.F, P.L.Eh Kan, ―Home Automation System with Android Application‖,3rd International Conference on Electronic Design (ICED), pp.no:299-303,2016. [8] Jui-Ho Chen, Wen-Tsai Sung and Guo-Yan Lin, ―Automated Monitoring System for the Fish Farm Aquaculture Environment‖ IEEE International Conference on Systems, Man, and Cybernetics,Vol No.57, Sec. 2,pp.no:1161-1166,2016.

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