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ESP32 POWERED SMART SURVEILLANCE FOR POULTRY FARM ENSURING FLOCK SAFETY

[1]P. Lahari,[2]P. Gayatri,[3]R. Sai Manisarma,[4]P. Durga Prasad,[5]S. Chandra Sekhar,[6]Mrs. G. Soundarya,

[7]Dr B. Siva Prasad

[1,2,3,4,5] B. Tech student Department of ECE, NSRIT, Vizag, AP, India

[6]Assistant Professor, Department of ECE, NSRIT, Vizag, AP, India

[7]Professor, Head of Department of ECE, NSRIT, Vizag, AP, India

ABSTRACT: This project introduces an innovative Internet of Things (IoT) solution tailored for poultry farming, integrating edge computing to streamline farm management. The system employs a ESP32 as the central controller, incorporating a Real-Time Clock for precise scheduling through a Bluetooth model. Stepper and Servo motors automate feeding, while relays regulate water supply, significantly minimizing manual intervention and ensuring timely nourishment for hens. Additionally, an IoT weather monitoring system is implemented, featuring a DHT11 sensor to measure temperature, smoke, and humidity. Data is transmitted to a cloud-based server, continuously compared with predefined thresholds, and displayed on an LCD board. In the event of critical conditions, the system triggers alerts and activates a buzzer, providing real-time warnings to nearby farm operators. Furthermore, an ultrasonic sensor is employed for intruder detection, capturing live images using an ESP-camera. The images are sent to the user's Gmail via an IoT server, along with information from sensors crossing predefined thresholds. This comprehensive approach enhances farm security and management, offering real-time warnings to operators and ensuring proactive responses to environmental and security challenges. The integration of edge computing, ESP32, and diverse sensors contributes to the efficiency, automation, and overall optimization of poultry farming practices.

KEYWORDS: Smart Poultry farm, Real-Time monitoring, Environment sensing, DHT11 sensor, ESP32, Automated feeding system, Smart farming

1. INTRODUCTION

The Internet of Things (IoT) is a transformative technological paradigm that has revolutionized the way devices interact and communicate, ushering in an era where the physical world seamlessly integrates with the digital realm. At its core, IoT is a vast networkof interconnected devices, each embedded with sensors, actuators, and other smart technologies that enable them to collect and exchange data. This interconnectivity facilitatesthe creation of intelligent, data-driven systems capable of making informed decisions and enhancing overall efficiency in various domains. The fundamental building blocks of the IoT ecosystem are the diverse array of devices, often referred to as "things." These can range from everyday objects like householdappliances and wearable devices to sophisticated industrial machinery and environmental sensors. What sets these devices apart is their ability to sense and gather data from the surrounding environment, creating a wealth of information that can be leveraged for analysisand action. Connectivity lies at the heart of the IoT infrastructure, enabling devices to communicate with each other and with centralized systems. Various communicationprotocols, such as Wi-Fi, Bluetooth, ZigBee, RFID, and cellular networks, facilitate this dataexchange. The choice of connectivity depends on factors like range, power consumption, and the specific requirements of the IoT application. The interconnected web of devices forms the foundation upon which the IoT architecture rests, allowing for the

seamless flowof data between the physical and virtual realms. Once data is collected by IOT devices, it undergoes processing to extract meaningful insights. This processing can occur either at the device level, known as edge computing, or in centralized cloud platforms. Edge computing involves on-site data processing, reducing latency and ensuring quick responses in applications that demand real-time analysis. On the other hand, cloud computing provides the scalability and computational power necessary for handling large volumes of data and performing complex analytics.

2. LITERATURE OF SURVEY

Glatz and Pym, 2006 [1]. Automation of poultry farms help to reduce the labour cost, increase farm efficiency, improve the productivity, and production rate of meat and egg. Wireless sensors and mobile system network to control and remotely monitor environmental parameters in a poultry farm, the system provides an efficient automated agriculture monitoring system.

K. Sravanth Goud et. Al.2015 [2]. Internet of issue based mostly sensible poultry farm can provides a trouble free and higher observation expertise to the user of the poultry farm. This method can create use of the sensors and microcontroller unit to perform the same operations of feeding, water system and temperature- humidness observation that area unit the most causes for any reasonably epidemic or diseases for poultry birds.

Rupali B. Mahale et. Al.2016 [3]. Use of an intelligent system which used an embedded framework and a wise Phone for monitoring farm to manage environmental parameters using smart devices and technologies.

Geetanjali A. Choukidaret. Al.2017 [4]. Automation of poultry farm by using wireless sensor network and mobile communication provides automated poultry, reduces man power and increases production of healthy chicken.

Raghudathest et al., 2017[5]. "IoT based intelligent poultry management system using Linux embedded system". The system proposed by Raghudatheshet al. (2017) monitors and regulates light intensity, temperature, air quality, and humidity. A camera is incorporated for image surveillance on the farm. The system was built around the Arduino Mega board and the Raspberry Pi 3, which acts as a server.

Ayyappan. V et. Al.2017 [6]. Automated system initiates the action automatically to control the environmental parameters such as humidity, temperature, ammonia gas and will decrease the environmental diseases affecting chicken and increase the productivity and eliminate a lot of manpower.

S. Arunkumaret. Al. 2018 [7]. The development of an automatic chicken feeding machine can be very useful to the growth of the poultry industry.

Mohammad R. Ahmadi, et. Al.2018 [8]. Wireless sensors and general pocket radio service network system provides an efficient automated poultry farm monitoring system to monitor the healthy atmosphere for chickens in poultry farm without human interference.

Eric Hitimana et. Al.2018 [9]. Field programmable gate array system by using internet of thing will automatically initiate the action to verify the environmental parameters in case of sudden climatic changes. In addition, the control of the water level and the food control mechanism are controlled and controlled with the help of the sensor. This system provides an efficient automated system for monitoring poultry farms to monitor the healthy atmosphere of chickens in poultry farming without human interference.

Sitaram et al., 2018[10] "IoT based smart management of poultry farm and electricity generation". An automated poultry farm management system based on IoT was proposed by Sitaram et al (2018). Monitor environmental parameters and conditions. A website was designed for the farmer to access the poultry data, which is transmitted using a GPRS module.

Ramgirwar S.S. et. Al.2018 [11]. Using the better system a farmer will management remotely his poultry farms through time period observation with a private laptop and cell phone.

K.A. Sitaram et. Al.2018 [12]. Automated environment-controlled poultry management system performs many operations for the usage of the farm efficiently, it monitors the temperature and humidity continuously and also monitors the food level in the container and indicate the owner using a mobile application by the help of a WIFI module, this system reduces the human effort and also increases the poultry production.

R. Sekar et. Al.2019 [13]. Poultry birds are generally reared in the litter system so it requires adequate space and related equipment facilities for the proper management of the flock. Modern poultry houses are fully automated with fans linked to sensors to maintain the required environment.

Sakshi Mishra et. Al.2019 [14]. Technology based solution for low cost, asset saving, quality oriented and productive management of chicken framing, by utilizing an intelligent system which used an embedded framework and smart phone for watching farm to regulate environmental parametersvictim ization good devices and technologies.

3. PROBLEM IDENTIFICATION

The development of an advanced security alerting system and auto-feeding solution for poultry farms is

prompted by the critical need to address existing challenges in the industry. Poultry farms face ongoing threats such as theft, trespassing, and unauthorized access, underscoring the necessity for a sophisticated security alerting system that can provide real-time alerts and proactive responses. Simultaneously, the manual process of feeding poultry presents operational inefficiencies, requiring a robust auto-feeding system for precise control over feeding schedules, promoting the overall health and growth of the birds. The proposed solution must seamlessly integrate with existing farm infrastructure, offering customization options to accommodate diverse farm layouts and security concerns. Real-time monitoring and reporting capabilities are crucial, enabling instant alerts for security breaches and detailed insights into feeding schedules, consumption patterns, and poultry health. Furthermore, the system should be scalable and affordable, ensuring accessibility for poultry farmers of varying scales. The integrated solution aims to revolutionize poultry farming by enhancing security measures, optimizing operational efficiency, and ultimately contributing to the sustainable

4. BLOCK DIAGRAM:

The block diagram shows a ESP32 Powered Smart Surveillance For Poultry Farm Ensuring Flock Safety. The following is a descriptive explanation of every component and what it does:

1. Regulated power supply:

Fig 1 RPS

Ensures stable operation of all electronic components.

2. ESP8266 wi-fi module:

Fig 2 ESP8266

provides unsurpassed ability to embed Wi-Fi capabilities within other systems, at the lowest cost with the greatest functionality

3. DHT11:

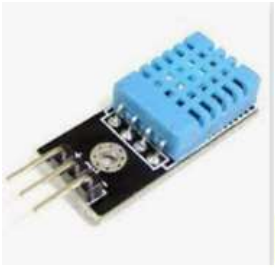

Fig3 Hence, sensing, measuring, monitoring and controlling humidity is a very important task. Some of the important areas of applicati

4. Real time clock{RTC DS1302):

Fig 4 RTC DS1302

Keeps track of the current dateand time,even when the main power supply is off.

5. Servo Motor:

Fig 5 Servo Motor

Provides controlled rotation for mechanisms built with gearing and feedback control loop circuit.

6. LCD:

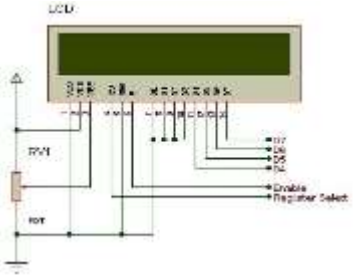

Fig 6

LCD The LCD (Liquid Crystal Display) in the system servers as a user friendly interface that provides real time information about the poultry farn conditions displaying sensor readings,system status and alerts the lcd becomes crucial tool for on-site monitoring.

4.3 Software Description:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - connects to the Arduino boards to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension.ino.

Using the offline IDE 1.x.x

The editor contains the four main areas:

1. A Toolbar with buttons for common functions and a series of menus. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

2. The message area, gives feedback while saving and exporting and also displays errors.

3. The text editor for writing your code.

4. The text console displays text output by the Arduino Software (IDE), including complete error messages and other information.

Fig 8 Arduino ide

5. Connect your Development board to your computer.

6. Now, you need to select the right core & board. This is done by navigating to Tools > Board > Arduino AVR Boards > Board. Make sure you select the board that you are using. If you cannot find your board, you can add it from Tools > Board > Boards Manager.

7. Now, let's make sure that your board is found by the computer, by selecting the port. This is simply done by navigating to Tools > Port, where you select your board from the list.

Fig 9 Arduino ide tool bar

4.4 Circuit Diagram:

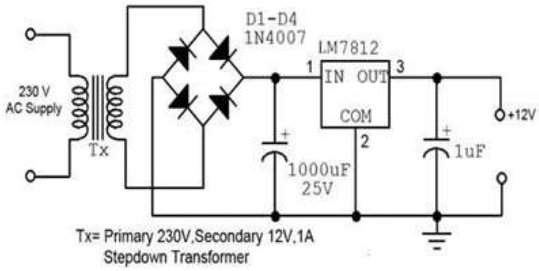

Fig 10 Circuit Diagram

The user selects the particular class to deliver a message; a microphone audio input device can be used to create live announcements. The audio input devices are connected to the central control system and can be used to create and broadcast live announcements in real-time. The central control system is the main component of the announcement system and is responsible for managing the flow of information. It is equipped with programmed Arduino and switches to create, select and manage announcements of class rooms. Speakers are placed in various locations, such as classrooms, laboratory, and common areas, to ensure that the announcements can be heard by the entire department.

4.5 Working of the System:

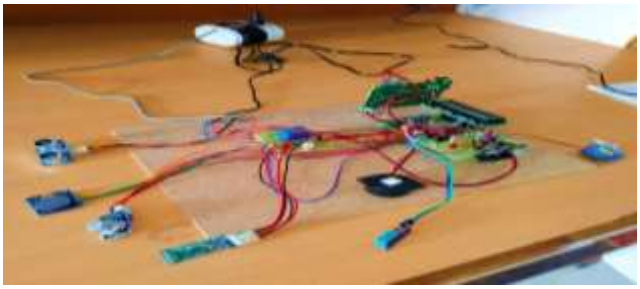

Fig 11 Photograph of a project model

- **Set up ESP32** with camera and sensors in the poultry area.
- **Write code** using Arduino IDE to make the ESP32 work with the camera and sensors.
- **Enable motion detection** to get alerts when something unusual happens.
- **Send data to the cloud** (e.g., Firebase or ThingSpeak) for remote monitoring.
- **Create a mobile app** (e.g., Blynk) to check the farm, get alerts, and control devices from your phone.

Fig 12 visual representation of a type of the Code.

FUTURE SCOPE:

The ESP32-powered smart surveillance system for poultry farms holds promising future potential across multiple dimensions. With advancements in artificial intelligence, such systems can be enhanced to detect unusual poultry behavior, identify potential health issues, or predict diseases early through pattern recognition. The surveillance setup can be expanded to include multiple camera modules, enabling full coverage of large poultry areas. Incorporating thermal imaging sensors can further allow for non-invasive health monitoring, such as detecting body temperature anomalies. The system can also be integrated with cloud services to store and analyze historical data, aiding in better farm management decisions over time. Real-time mobile notifications can keep farm owners updated on security breaches or abnormal conditions. Moreover, solar-powered ESP32 nodes can make the system sustainable and ideal for remote or off-grid farms. The integration of additional IoT sensors to monitor temperature, humidity, and gas concentrations like ammonia can provide a holistic view of

environmental conditions. As farms scale, mesh networking with multiple ESP32 devices can offer seamless connectivity and data sharing. Lastly, adopting edge computing can reduce latency and ensure critical decisions are made instantly, even with limited internet connectivity.

CONCLUSION:

In conclusion, the advent of IoT-enabled smart poultry farming marks a transformative shift in the agricultural landscape, offering numerous benefits for farmers and poultry alike. By integrating advanced technologies such as edge computing, sensor networks, this innovative approach revolutionizes farm management practices. Through the seamless automation of tasks like feeding, watering, and environmental monitoring, IoT smart poultry farming significantly reduces manual labor while ensuring optimal conditions for poultry health and productivity.Moreover, the enhanced security features, including intruder detection and remote monitoring capabilities, farm security and protect against potential threats. With alerts and notifications sent directly to farmers' devices, proactive responses to emergencies are facilitated, mitigating risks and safeguarding farm assets. Overall, IoT smart poultry farming represents a paradigm shift towards more sustainable, efficient, and secure agricultural practices. By harnessing the power of technology, farmers can optimize production, minimize risks, and ensure the well-being of their poultry, paving the way for a brighter and more prosperous future in poultry farming.

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