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IoT Based Animal Husbandry

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Abstract: *IoT is expanding its reach in all aspects of life while instantly adapting to our lifestyle. Its ability to transmit information real-time quick, accurate, and reliable has been advantageous to various domains. Animal husbandry has a significant contribution to the world's economy. The use of sensors for the overall welfare management of cattle and poultry animals has increased in the past few years. The constant development in IoT has created scope of opportunities in the field of animal and livestock management. The proposed system includes hardware, software and an alert system that aims to improve the health of the cattle. The growth in the applications of IoT in all aspects of our lives has an increased potential for reliably transmitting the necessary information. The use of IoT to constantly monitor the health of individual cattle reduces the farmers' work and improves the life quality of the livestock.*

Keywords: Cattle, Cloud Server, Internet of Things (IoT), Livestock Management, Motion Sensor, RFID, Temperature Sensor.

I. INTRODUCTION

ANIMAL husbandry and livestock play a crucial role in the backbone of the economy. Due to the recent pandemic, there has been a decrease in the workforce and increased difficulty in resource management. Dairy farming has been gradually shifting more profit-making aspect. This shift is due to demand for their products and quality.

A) The internet is one of the most transformative technologies. It has made an everlasting impact on every aspect of our lives. The concept of IoT involves interrelated computing devices, people or animals, objects. These "things" connect and exchange data over the internet or via other communication networks available. IoT includes various transmitters transmitting the data and receivers. Since its development in 1982, the advances in IoT has created a scope for improvement in every field; engineering, medical, life sciences, banking & finance, etc.

B) The Internet of Things (IoT) involves mechanical and computerized machines, items, or individuals with special identifiers and the capacity to exchange information over a system without expecting human-to-human or human-to-computer association. Animal Husbandry is the study of rearing, encouraging, and tending cattle.

Today, there is a want to integrate all the available sensors and create an efficient online monitoring system to maintain animal health and thereby increase productivity. The system can be monitored in real-time, right now. India has the largest livestock numbers in the world. Sound and on-time availability of Big Data is essential for any planning and policymaking purposes. Using IoT implementation applications has become a very reliable and powerful resource of processed information. This information can further be used for animal health welfare.

The paper further discusses Literature survey, the Proposed System, Results, Future Scope of the system and the Conclusions that can be derived from the study followed by the references.

II. LITERATURE SURVEY

The paper by Tariq A Raja, Azmat Khan, Irshad Ahmad Najar on Internet of Things (IoT) for animal husbandry-and outlook in livestock and poultry Focused on broadly categorizing the information needed as input procurement, a package of practices, disease forecasting and forewarning, preservation and value addition, past trends, and marketing information by using tools ike Database management system, Information Retrieval System, Trend Analysis, etc [1]

The paper presented by Bernard Ijesunor Akhigbe, Kamran Munir, Olugbenga Akinade, Lukman Akanbi, Lukumon O. Oyedele, discussed a system that proposed a way of maintaining the quality of life of the livestock and the condition of the land where they are farmed. Appropriate behavior, good health, good housing, timely feeding and environmental conditions were few principles for assessing animals. [2]

In the paper presented by Dr. Kirti Wankhede, Manisha Pathakala involved sensors that measured various health factors,

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motion and location tracking. The retrieved data and graphs were demonstrated by Wi-Fi module ESP8266 to examine the overall health of the animals. It had three significant units; data gaining unit, data interact unit and administering unit.[3]
The paper by Meenakshi .M, Snehal. S. Kharde had biosensors for observing and maintaining the health of animals by tracking their metabolism, analyse their breathing and fitness. The data gain unit included various sensors measuring factors such as temperature, respiration, heartbeat, etc mounted on cattle body. The data was transferred with help of ESP8266 to Arduino and the data administering unit This proved to be beneficial in this regard, giving insight into the monetary results of such investments [4]

The system proposed by T. Vigneswari, N. Kalaiselv, K. Mathumitha of animal monitoring system has various features like live location based tracking, health monitoring, and a smart feeding technology to control quality and quantity of the feed given to animals. The survey compared various health monitoring systems. A Cloud IoT- based LMS(Livestock monitoring System) had features like a wearable collar for monitoring and recording the animal health parameters using IoT sensors, identification of livestock using UID and display of the details via wireless by QR code reading and processing. It compared various animal health monitoring systems and tracking systems with some major disadvantages like higher costs of installation and maintenance. A Zigbee based animal health monitoring system by (Kumar, A., 2015) noted factors such as heart rate, temperature, rumination with respect to the surrounding environment.[5]

III. PROPOSED SYSTEM

The proposed system consists of Wi-Fi module, sensors and an cost effective and efficient way to monitor cattle from a distance. Depending on the changes observed at data storage unit, the user can make wise decisions to increase overall productivity of cattle. The system has transmitted section and a receiving end, connected by Wi-Fi Module ESP8266.

3.1 Block Diagram

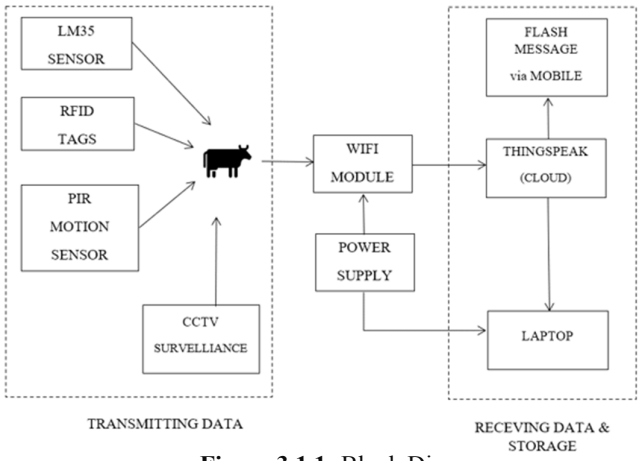

Figure 3.1.1: Block Diagram

The fig. 3.1.1., has two sections and a transmission medium. The transmitting data unit consists of various sensors, and the receiving data unit includes ThingSpeak. The received data is stored on a laptop in form of sheets.
The Architecture consists of:

1. WIFI Module
2. Input Sensors
3. Receiving Data and Storage unit
4. Power Supply

The proposed project consists of WIFI module at its core and acting as a medium to receive data. Node MCU ESP8266 is low cost IoT platform and permits data transfer using Wi-Fi. The WIFI module consists of SOC with integrated TCP/IP protocol that provides access to WIFI network. The input sensors consist of LM35 temperature sensor (to monitor change in temperature), PIR motion sensor (for activity observation) and RFID tags (to track location).

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All the sensors will be attached to the cattle animals whose data will be then received on laptop which is on the receiving end. Data is stored on ThingSpeak Server in form of sheets. With help of IFTTT an alert message is sent on user's mobile.

3.2 Workflow

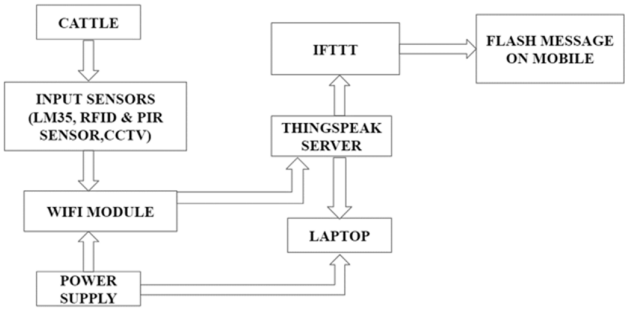

Fig. 3.2.1: Workflow

Fig 3.2.1 efficiently depicts process of the system. It helps in increasing understanding each step involved in implementing this system successfully. We will be connecting input sensors like LM35, PIR sensor and RFID tags near cattle (cows). These sensors will help in detecting cow's movements and pass on the inputs to wifi module. Thus, helping in tracking cow's location. This Wi-Fi module (Node MCU ESP8266) will transfer sensed data to the ThingSpeak Server on laptop. The received data will be processed and further for storage purpose saved in form of sheets laptop. By using IFTTT software, a flash message is sent on user's mobile to notify the changes.

3.3 Hardware specification

A. Node MCU (ESP 8266)

Fig. 3.3.1: Node MCU

Node MCU is an open-source development board used specifically for IoT based applications. **ESP8266** has Wi-Fi SoC and has 128Kb of Ram, 4 MB of Flash memory, and a maximum clock speed of 160MHz (80 -160). The operating current is 80mA(average). It operates at 3.3 V. The NodeMCU is available in various package styles. Common to all the designs is the base ESP8266 core. Designs based on the architecture have maintained the standard 30-pin layout.

B. RFID

Fig. 3.3.2. RFID

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The **RC522** is a **13.56MHz RFID module and supports** I2C, SPI and UART. It operates between 2.5V to 3.3V. The maximum data rate for **RC522** is 10Mbps. Low-voltage, low-cost, small size of the non-contact card chip to read and write. Suitable for Smart meters and portable handheld devices.

D. Temperature Sensor

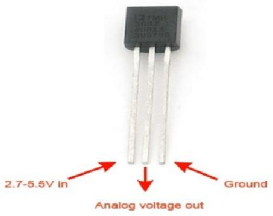

Fig. 3.3.3. Temperature Sensor

LM35 is an integrated analog temperature sensor whose electrical output is proportional to Degree Centigrade. **LM35** Sensor does not require any external calibration or trimming to provide typical accuracies. The **LM35's** low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. Main advantage of **LM35** is that it is linear i.e., 10mv/°C which means for every degree rise in temperature the output of **LM35** will rise by 10mv. So, if the output of LM35 is 220mv/0.22V the temperature will be 22°C. So, if room temperature is 32°C then the output of **LM35** will be 320mv i.e., 0.32V**.**

E. PIR Motion Sensor

Fig. 3.3.4. PIR Motion Sensor

Passive Infrared Sensor (**PIR**) detects changes in light reflected on an object at a distance and gives out an output as an electrical signal. The result varies as the object moves away or moves within the sensor's range. Cover distance of about 120° and 7 meters, Low power consumption of 65mA, Operating temperature from -20° to +80° Celsius. The **PIR** sensor module can be powered from voltage 4.5V to 20V.

3.4 Software Used

A. Arduino IDE

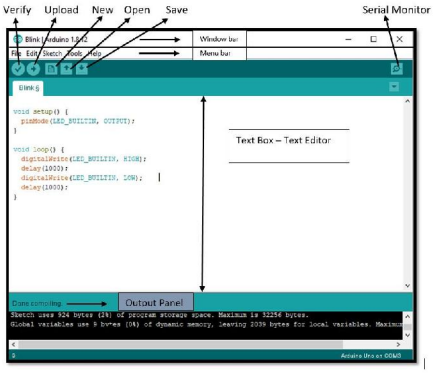

Fig. 3.4.1. Arduino IDE

Arduino IDE (**Integrated Development Environment**) is the software for Arduino. It is a text editor like a notepad with different features. It is used for writing code, compiling the code to check if any errors are there and uploading the code

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to the Arduino. It is a cross-platform software which is available for every Operating System like Windows, Linux, mac OS. It supports C/C++ language It is open-source software, where the user can use the software as they want it to. They can also make their own modules/functions and add them to the software. When a user writes code and compiles, the IDE will generate a Hex file for the code. (Hex file are Hexa Decimal files which are understood by Arduino) and then sent to the board using a USB cable. Every Arduino board is integrated with a microcontroller, the microcontroller will receive the hex file and runs as per the code written.

B. ThingSpeak Server

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. You can send data to **ThingSpeak** from your devices, create instant visualization of live data, and send alerts. Its features include collection of data in private channels, share data with public channels, RESTful and MQTT APIs, MATLAB analytics, Event scheduling Alerts.

C. IFTTT

IFTTT allows you to do more with over 700 different apps and services including Twitter, Dropbox, Evernote, Fitbit, Amazon Alexa, and Google Assistant. On IFTTT, we call these services. A list of all services on IFTTT can be found here We bring services together into Applets, automations that allow you to do things your apps and devices can't do on their own. For example, you could use IFTTT to sync Amazon Alexa to-dos with your Google Calendar or create events in your iPhone Calendar via Google Assistant IFTTT is short for 'If This Then That', and is pronounced like 'Gift' without the 'G'. We used to be called 'if this, then that' because Applets would have one trigger and one action. If this happens — then that happens. For example, when you come home, then turn on your Hue lights Now we just go by IFTTT, because there's so much more you can do: Applets can have multiple actions (If this, then that, that, and that) Applets can run when you tell them to, at the touch of a Button (That!) And some Applets even have filters that mean they only run when a specific condition is met (If this and this, then that).

D. IP Webcam

A typical Android smartphone, old or new, comes with at least one camera. Meanwhile, the Android operating system lets developers create apps that do almost anything. This makes Android an ideal platform for use as an IP webcam. All you need to do is enable Wi-Fi, find the right app, set it up, then position your Android device as required. The result is a steady IP webcam picture streamed across the web. You can view the footage in any browser.

IV. RESULT

4.1 Hardware

The entire project is divided into sections as seen in Fig. 3.1.1.
The data transmitting section consist of

Fig 4.1. Hardware

Fig. 4.1., represents hardware components.

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4.2 ThingSpeak Server

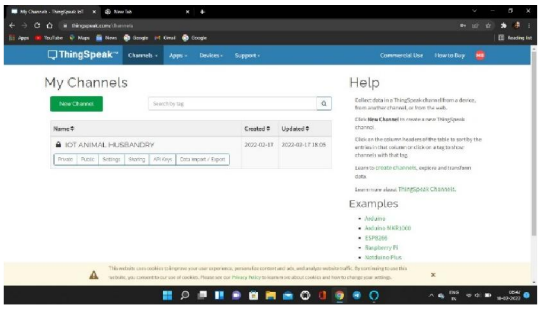

Fig. 4.2. ThingSpeak Server

ThingsSpeak Server acts as a server to store data on real-time basis. Data can be visualized in from graphics and in form excel sheets.

4.3 Data Sheet

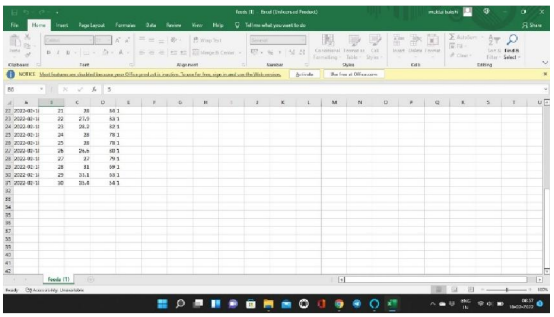

Fig. 4.3. Data Sheet

In data sheet, previous data is stored which can be used in future. In addition to the existing data, new data is added in the data sheet. Previous data and real time data can be separate blocks.

4.4 Flash Message

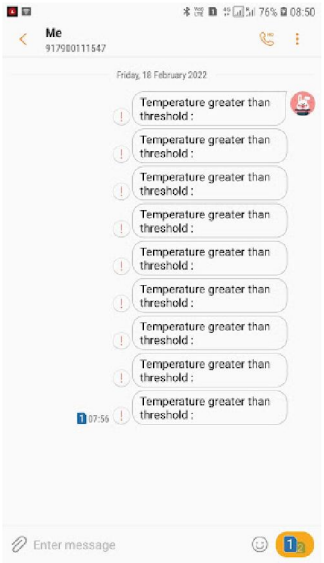

Fig. 4.4. Flash Message

With help of IFTTT, a flash message can be sent on the user's mobile. The message acts an alert when the temperature crossed the threshold values. This data is essential in identifying underlying diseases.

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V. CONCLUSION

The Covid-19 pandemic has impacted human lifestyles in many ways. People have changed hygiene regimes tremendously. Similarly, industry of animal husbandry faced drastic changes and need for upgradation. By implementing various sensor along with IoT, it can be of great help to monitor animal health, to organise animals in a way to improve livestock production. By implementing IoT, efforts to make this monitoring user friendly have been taken. This will also help in boosting economic status of livestock. With constant upgrading technology and advanced sensors, automating of cattle farms has great development poten-tial, if adopted correctly and on large scale.

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