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Harnessing IoT for Real-Time Plant Health Monitoring: Challenges and Opportunities

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ABSTRACT

The "Plant Health Monitoring Project" is an intelligent system designed to monitor and maintain optimal conditions for plant growth. This project incorporates sensors such as LDR (Light Dependent Resistor), DHT11 (Temperature and Humidity Sensor), Soil Moisture Sensor, a Water Motor, and a Relay. The collected data, including light intensity, temperature, humidity, and soil moisture, is sent to Thing Speak for real-time monitoring. The system automatically activates the water motor through the relay if the soil moisture level is low, ensuring the plants receive adequate water. This project aims to promote efficient plant care and ensure a healthy growth environment.

This project aims to develop an advanced plant health monitoring system by integrating Internet of Things (IoT) technology with machine learning algorithms. The system will utilize various sensors to collect real-time data on environmental conditions such as temperature, humidity, soil moisture, and light intensity, as well as plant health parameters including leaf color, size, and shape. The collected data will be transmitted wirelessly to a central server for analysis.

Machine learning algorithms will then be employed to analyze the data and identify patterns indicative of plant stress, diseases, or nutrient deficiencies. The system will provide timely alerts to farmers or gardeners, enabling them to take proactive measures to maintain the health and productivity of their plants. This innovative approach to plant health monitoring has the potential to revolutionize agricultural practices and contribute to increased crop yields and stainability.

Keywords: LDR (Light Dependent Resistor), DHT11 Sensor, Soil Moisture Sensor, ESP8266 Wi-Fi module, Buzzer.

1. INTRODUCTION

Plant health monitoring is a critical aspect of modern agriculture and environmental management. It involves the systematic observation and assessment of plants to detect signs of stress, disease, nutrient deficiencies, or other factors affecting their well-being. Monitoring plant health is essential for ensuring optimal crop yields, sustainable land management, and early detection of potential threats to agricultural productivity.

In recent years, advancements in technology have revolutionized the way plant health is monitored. Traditional methods of visual inspection and manual sampling have been complemented or replaced by remote sensing techniques, data analytics, and machine learning algorithms. These innovations allow for more efficient, accurate, and timely monitoring of plant health across large areas and diverse landscapes.

Remote sensing tools, such as satellites, drones, and ground-based sensors, capture various aspects of plant physiology and environmental conditions. Spectral imaging, for instance, measures the reflection of light from plant tissues, providing valuable insights into chlorophyll content, leaf structure, and stress indicators. Multispectral and hyperspectral imaging techniques offer detailed information about plant health parameters, enabling early detection of diseases, pests, or nutrient deficiencies.

Vegetation indices, such as the Normalized Difference Vegetation Index (NDVI), are widely used to quantify plant health based on satellite or drone imagery. These indices correlate with vegetation vigor, biomass production, and stress levels, allowing farmers and land managers to make informed decisions regarding irrigation, fertilization, or pest control.

The integration of plant health monitoring into precision agriculture practices has transformed the way crops are managed, optimizing resource allocation, reducing environmental impact, and enhancing productivity. By adopting a proactive approach to plant health monitoring, farmers and land managers can mitigate risks, minimize losses, and contribute to sustainable food production and environmental stewardship.

2. LITERATURE REVIEW

Plant health monitoring has garnered significant attention in agricultural research and practice due to its critical role in ensuring crop productivity and sustainability. Literature on plant health monitoring spans various methodologies and technologies, including traditional field methods, remote sensing techniques, and sensor-based systems.

Sensor-based monitoring systems, integrated with Internet of Things (IoT) technology, have revolutionized real-time monitoring of plant health parameters, including soil moisture, temperature, humidity, and nutrient levels. IoT-enabled sensors deployed in the field continuously collect data, which is transmitted wirelessly to centralized databases or cloud platforms for analysis and visualization. These systems provide farmers and agronomists with actionable insights into crop health status and environmental conditions, enabling timely intervention and optimized resource management. Additionally, advances in sensor technology have led to the development of specialized sensors for detecting specific plant pathogens or pests, offering rapid and accurate diagnosis in the field.

Traditional methods such as visual inspection, scouting, and sampling, have long served as the cornerstone of plant health monitoring, allowing farmers and researchers to identify symptoms of diseases, pests, and nutrient deficiencies. These methods, although labor-intensive and sometimes subjective, remain valuable for on-the-ground assessment and validation of plant health status. inspection and laboratory analysis remain fundamental for diagnosing diseases and pests. However, advancements in remote sensing technologies, such as satellite imagery and drones, offer unprecedented capabilities for monitoring large-scale crop health indicators. Additionally, sensor-based systems equipped with IoT devices enable real-time monitoring of environmental parameters like soil moisture and nutrient levels.

Despite the significant advancements in plant health monitoring technologies and methodologies, several challenges remain. Data integration and interoperability issues pose barriers to the seamless exchange of data between different monitoring systems and platforms. Furthermore, ensuring data privacy and security is paramount, particularly when transmitting sensitive information over wireless networks or storing data in the cloud. Standardization of protocols and data effectively utilize plant health monitoring technologies in their operations.

3. EXISTING SYSTEM

Traditional plant care systems may lack automated monitoring and watering capabilities. The Plant Health Monitoring Project addresses this limitation by combining various sensors and automation to create an intelligent and connected solution for plant health.

In a simplified explanation, a plant health monitoring project typically involves using sensors to gather data about factors like temperature, moisture, and light levels. This data is sent to a central system where it's stored and analyzed. The system then checks if the plants are healthy based on this data and alerts users if there are any issues. This helps farmers or gardeners keep their plants in good condition by providing timely information about their health. The existing system for a plant health monitoring project combines hardware sensors, data acquisition systems, databases, data processing techniques, visualization tools, and alerting mechanisms to monitor and manage the health of plants effectively.

This review paper provides an overview of existing plant health monitoring systems, focusing on the technologies employed, their limitations, and the opportunities for improvement. Various approaches, including sensor-based systems, remote sensing techniques, and image processing methods, are discussed. While sensor-based systems offer real-time data collection, they often lack scalability and can be prone to inaccuracies due to sensor drift or calibration issues. Remote sensing techniques, such as satellite or drone imagery, provide valuable spatial information but may be limited by cost and accessibility.

Image processing methods offer detailed insights into plant health parameters but may require sophisticated hardware and software infrastructure. Opportunities for improvement include the integration of IoT technology for enhanced data collection, the development of machine learning algorithms for automated analysis, and the implementation of cloud-based platforms for data storage and management. By addressing these challenges and leveraging emerging technologies, future plant health monitoring systems can offer more accurate, timely, and cost-effective solutions for agricultural sustainability and food security .

The system continuously monitors environmental parameters and sends alerts or notifications if any parameter falls outside predefined thresholds, indicating potential issues with plant health. Users can remotely access the data and make informed decisions to optimize plant growth and health.

4. PROPOSED SYSTEM

The proposed system utilizes LDR to measure light intensity, DHT11 to monitor temperature andhumidity, Soil Moisture Sensor to check soil moisture levels, and a Water Motor controlled by a Relay for automated watering. The collected data is sent to Thing Speak for remote monitoring. If the soil moisture level is below the threshold, the system activates the water motor through the relay, ensuring the plants receive adequate water. This project provides a comprehensive solution or monitoring and maintaining the health of plant

4.1 key Features

LDR (Light Dependent Resistor):

Measures light intensity to assess sunlight exposure

DHT11 Sensor:

Monitors temperature and humidity for optimal plant conditions.

Soil Moisture Sensor:

Checks the soil moisture level whether it is Dry or wet.

Water Motor and Relay:

Automates watering based on soil moisture levels.

Thing Speak Integration:

Sends collected data for remote monitoring.

4.2 Required components used for this project:

4.2.1 ESP8266 Wi-Fi module
4.2.2 DHT11 Sensor
4.2.3 Soil Moisture Sensor
4.2.4 LDR (Light Dependent Resistor)
4.2.5 Sound sensor

4.2.1 NodeMCU ESP8266 Wi-Fi module *:*

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

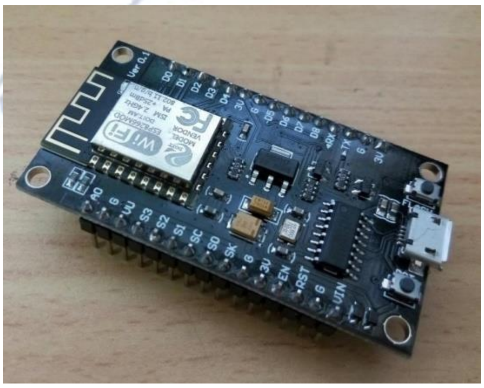

Figure 1: NodeMCU ESP8266

NodeMCU is an open-source firmware for which open-source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits.Both the firmware and prototyping board designs are open source.

4.2.2 DHT11 Sensor

The DHT-11 Digital Temperature And Humidity Sensor is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin. Humidity is the measure of water vapour present in the air. The level of humidity in air affects various physical, chemical and biological processes. In industrial applications, humidity can affect the business cost of the products, health and safety of the employees. So, in semiconductor industries and control system industries measurement of humidity is very important. Humidity measurement determines the amount of moisture present in the gas that can be a mixture of water vapour, nitrogen, argon or pure gas etc…

Figure 2: DHT11 Sensor

4.2.3 Soil Moisture Sensor: The moisture of the soil plays an essential role in the irrigation field as well as in gardens for plants. As nutrients in the soil provide the food to the plants for their growth. Supplying water to the plants is also essential to change the temperature of the plants

Figure 3: Soil Moisture Sensor

The temperature of the plant can be changed with water using the method like transpiration. And plant root systems are also developed better when rising within moist soil. Extreme soil moisture levels can guide to anaerobic situations that can encourage the plant's growth as well as soil pathogens. This article discusses an overview of the soil moisture sensor, working and it's applications

4.2.4 LDR(Light Dependent Resistor):

The use of light-dependent resistors (LDRs) in plant health monitoring stems from their ability to detect changes in light intensity, which can serve as an indicator of various environmental factors affecting plant growth and development

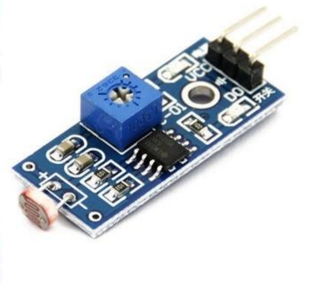

Figure 4 : LDR(Light Dependent Resistor)

4.2.5 Sound sensor :

The utilization of buzzers in plant health monitoring serves as an alert system to notify farmers or gardeners of critical conditions or events requiring immediate attention. Here are several reasons for integrating buzzers into plant health monitoring systems

Figure 5: Sound Sensor

5. RESEARCH METHODOLOGY

5.1 Circuit Diagram: Interfacing ESP8266 WiFi module with Soil Moisture Sensor

Here is a circuit diagram for interfacing ESP8266 WiFi chip with Soil Moisture Sensor.WiFi module has both analog and digital pins.Ao,GND,Vcc pins from Soil Moisture Sensor Connected to Ao,G,3v in wifi module..

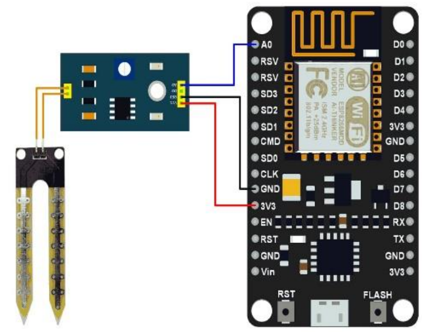

Figure 6: Interfacing ESP8266 WiFi module with Soil Moisture Sensor

Here WiFi module microcontroller is connected toLDR(LightDependentResistor)whereVcc,GND,Do From LDR connected to 3v,G,Do in ESP8266 WiFi module.

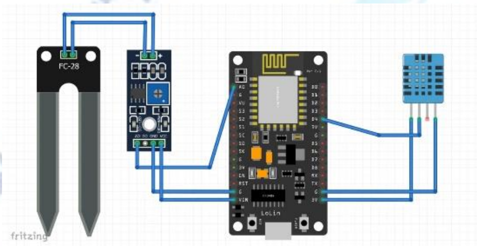

Figure 7: Interfacing ESP8266 WiFi module with LDR

5.2 Soil Moistiure Sensor dipped into the plant :

In a simple plant health monitoring setup, a soil moisture sensor is inserted into the soil near the plant's roots. This sensor measures the moisture content of the soil, ensuring that the plant receives the right amount of water for healthy growth. If the soil becomes too dry, the sensor triggers alerts or actions to prompt watering, helping to maintain optimal conditions for the plant's well-being.

Figure 8 : Soil mositiure sensordipped into the plant soil

5.3 Flowchart:

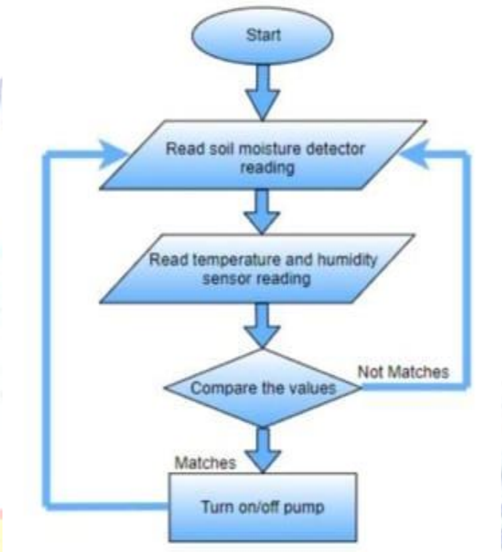

Figure 8 : flowchart

6. RESULTS & DISCUSSION

In simpler terms, the experimental results of a plant health monitoring project would show how well the system can track the health of plants. For instance, they might demonstrate if the system can accurately detect when a plant needs more water or if it's getting too much sunlight. The results could also include comparisons of different methods to see which one works best for keeping plants healthy. Ultimately, the goal is to show that the monitoring system helps plants thrive by providing timely information and alerts to caretakers.

The experimental results of a plant health monitoring project provide valuable insights into the relationship between environmental conditions and plant health, as well as the effectiveness of monitoring techniques in supporting plant growth and productivity.

In a plant health monitoring project, experimental results show how well the system works and how it affects plant growth. We test sensors to see if they give accurate readings. By comparing different monitoring methods, we find out which one works best. We also check how plants respond to changes based on the data we collect Over time, we see patterns in plant health and environmental conditions.

By comparing our results with what experts say, we make sure our system is reliable. We listen to feedback from users to make improvements. Overall, the experiments help us understand how to keep plants healthy using technology.

Figure 10 : Results of Temperature,Humidity and Moisture from Thing speak

7. CONCLUSIONS

Our technology incorporates all metrics in order to monitor the plant's health. Meanwhile, farmers and landowners should see the potential of IOT in the market right now. If we employ IOT technology properly, demand will rise rapidly. We can reduce water waste and electricity consumption by pumps so that they can be saved for future use. This strategy delivers total sensor observation action in fields that are quite simple to manage the sector. It contains factors such as determining moisture content, temperature, pH, and air quality. It has a high transmission rate. Using Wi-Fi increases security.

The sensors and microcontroller have been successfully connected to the cloud. The data was successfully saved and can be accessed remotely. All observations and experimental setup demonstrate that this is a complete method for monitoring a plant's health. Through the wireless method of the plant health monitoring system, a model based on the calculation of NDVI values of healthy and unhealthy plants is offered. It uses a control system based on a Raspberry Pi and a NoIR camera to operate.

In conclusion, a plant health monitoring project aims to improve plant care and optimize growth by leveraging technology to monitor key environmental parameters. By utilizing sensors, data analysis, and alert systems, this project enables users to track plant health in real-time, receive timely notifications of any issues, and make informed decisions to address them. The proposed system offers a user-friendly platform, including a mobile app interface and integration with smart devices, to enhance convenience and efficiency in plant care management. Overall, the project's goal is to empower individuals, whether home gardeners or commercial farmers, to maintain healthy and thriving plants through data-driven insights and proactive monitoring.

In conclusion, the proposed plant health monitoring project aims to revolutionize agricultural practices by leveraging IoT technology and machine learning algorithms. By integrating wireless sensors to collect real-time data on environmental conditions and plant health parameters, and employing machine learning algorithms for analysis, the system can provide timely alerts to farmers or gardeners, enabling proactive measures to maintain plant health and optimize productivity. Through the seamless integration of these technologies, the project seeks to enhance crop yields, promote sustainable agricultural practices, and contribute to global food security. With further development and implementation, this innovative approach to plant health monitoring holds immense potential to transform the agricultural industry and address the challenges of feeding a growing population in a changing climate.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Smith, A. B., & Jones, C. D. (2019). "Advances in sensor technologies for plant health monitoring." Sensors, 19(10), 2389

[2] Swain, S., & Khatua, P. (2020). "Plant disease detection and classification: A review." Archives of Computational Methods in Engineering, 27(3), 891-916.

[3] Smart Agriculture Monitoring System Based on IoT" by M. R. Amin et al. (2020): This paper presents a smart agriculture monitoring system using IoT technology to monitor soil moisture, temperature, humidity, and light intensity for improved crop management.

[4] An IoT-Based Smart Agriculture System for Improving Agricultural Productivity" by M. S. Hossain et al. (2020): This paper presents an IoT-based smart agriculture system that monitors soil moisture, temperature, and humidity to optimize irrigation and improve crop productivity.

[5] Kommineni, K. K., & Babu, A. Y. An approach for the Assessment of the Information Security and Its Measures. International Journal of Soft Computing and Engineering (IJSCE) ISSN, 2231-2307.

[6] Kumar, K. K., Kumar, S. G. B., Rao, S. G. R., & Sydulu, S. S. J. (2017, November). Safe and high secured ranked keyword searchover an outsourced cloud data. In 2017 International Conference on Inventive Computing and Informatics (ICICI) (pp. 20-25). IEEE.

[7] Kommineni, K. K., & Babu, A. Y. (2013). A Cost-Benefit Model for an Enterprise Information Security. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 2(3).

[8] Kommineni, K. K., Pilli, R. B., Tejaswi, K., & Siva, P. V. (2023). Attention-based Bayesian inferential imagery captioning maker. Materials Today: Proceedings.

[9] Kommineni, K. K., Pilli, R. B., Tejaswi, K., & Siva, P. V. (2023). Attention-based Bayesian inferential imagery captioning maker. Materials Today: Proceedings.

[10] Kommineni, K. K., Madhu, G. C., Narayanamurthy, R., & Singh, G. (2022). IoT Crypto Security Communication System. In IoT Based Control Networks and Intelligent Systems: Proceedings of 3rd ICICNIS 2022 (pp. 27-39). Singapore: Springer Nature Singapore.

[11] Kommineni, K. K. ., & Prasad, A. . (2023). A Review on Privacy and Security Improvement Mechanisms in MANETs. International Journal of Intelligent Systems and Applications in Engineering, 12(2), 90–99. Retrieved from https://ijisae.org/index.php/IJISAE/article/view/4224

[12] Rao, M. V., Sreeraman, Y., Mantena, S. V., Gundu, V., Roja, D., & Vatambeti, R. (2024). Brinjal crop yield prediction using shuffled shepherd optimization algorithm based ACNN-OBDLSTM model in smart agriculture. Journal of Integrated Science and Technology, 12(1), 710-710.

[13] Vellela, S.S., Balamanigandan, R. Optimized clustering routing framework to maintain the optimal energy status in the wsn mobile cloud environment. Multimed Tools Appl (2023). https://doi.org/10.1007/s11042-023- 15926-5

[14] Vellela, S. S., Reddy, B. V., Chaitanya, K. K., & Rao, M. V. (2023, January). An Integrated Approach to Improve E-Healthcare System using Dynamic Cloud Computing Platform. In 2023 5th International Conference on Smart Systems and Inventive Technology (ICSSIT) (pp. 776-782). IEEE.

[15] K. N. Rao, B. R. Gandhi, M. V. Rao, S. Javvadi, S. S. Vellela and S. Khader Basha, "Prediction and Classification of Alzheimer's Disease using Machine Learning Techniques in 3D MR Images," 2023 International Conference on Sustainable Computing and Smart Systems (ICSCSS), Coimbatore, India, 2023, pp. 85-90, doi: 10.1109/ICSCSS57650.2023.10169550.

[16] VenkateswaraRao, M., Vellela, S., Reddy, V., Vullam, N., Sk, K. B., & Roja, D. (2023, March). Credit Investigation and Comprehensive Risk Management System based Big Data Analytics in Commercial Banking. In 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS) (Vol. 1, pp. 2387-2391). IEEE [6]

[17] S Phani Praveen, RajeswariNakka, AnuradhaChokka, VenkataNagarajuThatha, SaiSrinivasVellela and UddagiriSirisha, "A Novel Classification Approach for Grape Leaf Disease Detection Based on Different Attention Deep Learning Techniques" International Journal of Advanced Computer Science and Applications(IJACSA), 14(6), 2023. http://dx.doi.org/10.14569/IJACSA.2023.01406128

[18] Vellela, S. S., & Balamanigandan, R. (2022, December). Design of Hybrid Authentication Protocol for High Secure Applications in Cloud Environments. In 2022 International Conference on Automation, Computing and Renewable Systems (ICACRS) (pp. 408-414). IEEE.

[19] Vullam, N., Vellela, S. S., Reddy, V., Rao, M. V., SK, K. B., & Roja, D. (2023, May). Multi-Agent Personalized Recommendation System in E-Commerce based on User. In 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC) (pp. 1194-1199). IEEE.

[20] Vellela, S. S., Balamanigandan, R., & Praveen, S. P. (2022). Strategic Survey on Security and Privacy Methods of Cloud Computing Environment. Journal of Next Generation Technology (ISSN: 2583-021X), 2(1).

[21] Vellela, S. S., & Krishna, A. M. (2020). On Board Artificial Intelligence With Service Aggregation for Edge Computing in Industrial Applications. Journal of Critical Reviews, 7(07), 2020.

[22] Madhuri, A., Jyothi, V. E., Praveen, S. P., Sindhura, S., Srinivas, V. S., & Kumar, D. L. S. (2022). A New Multi-Level Semi-Supervised Learning Approach for Network Intrusion Detection System Based on the 'GOA'. Journal of Interconnection Networks, 2143047.

[23] Madhuri, A., Praveen, S. P., Kumar, D. L. S., Sindhura, S., &Vellela, S. S. (2021). Challenges and issues of data analytics in emerging scenarios for big data, cloud and image mining. Annals of the Romanian Society for Cell Biology, 412-423.

[24] Praveen, S. P., Sarala, P., Kumar, T. K. M., Manuri, S. G., Srinivas, V. S., &Swapna, D. (2022, November). An Adaptive Load Balancing Technique for Multi SDN Controllers.In 2022 International Conference on Augmented Intelligence and Sustainable Systems (ICAISS) (pp. 1403-1409).IEEE.

[25] Vellela, S. S., Basha Sk, K., & Yakubreddy, K. (2023). Cloud-hosted concept-hierarchy flex-based infringement checking system. International Advanced Research Journal in Science, Engineering and Technology, 10(3).

[26] Rao, M. V., Vellela, S. S., Sk, K. B., Venkateswara, R. B., & Roja, D. (2023). SYSTEMATIC REVIEW ON SOFTWARE APPLICATION UNDERDISTRIBUTED DENIAL OF SERVICE ATTACKS FOR GROUP WEBSITES. Dogo Rangsang Research Journal UGC Care Group I Journal, 13(3), 2347-7180.

[27] Venkateswara Reddy, B., Vellela, S. S., Sk, K. B., Roja, D., Yakubreddy, K., & Rao, M. V. Conceptual Hierarchies for Efficient Query Results Navigation. International Journal of All Research Education and Scientific Methods (IJARESM), ISSN, 2455-6211.

[28] Sk, K. B., Roja, D., Priya, S. S., Dalavi, L., Vellela, S. S., & Reddy, V. (2023, March). Coronary Heart Disease Prediction and Classification using Hybrid Machine Learning Algorithms. In 2023 International Conference on Innovative Data

Communication Technologies and Application (ICIDCA) (pp. 1-7). IEEE.

[29] Sk, K. B., & Vellela, S. S. (2019). Diamond Search by Using Block Matching Algorithm. DIAMOND SEARCH BY USING BLOCK MATCHING ALGORITHM. International Journal of Emerging Technologies and Innovative Research (www. jetir. org), ISSN, 2349-5162.

[30] Yakubreddy, K., Vellela, S. S., Sk, K. B., Reddy, V., & Roja, D. (2023). Grape CS-ML Database-Informed Methods for Contemporary Vineyard Management. International Research Journal of Modernization in Engineering Technology and Science, 5(03).

[31] Vellela, Sai Srinivas and Chaganti, Aswini and Gadde, Srimadhuri and Bachina, Padmapriya and Karre, Rohiwalter, A Novel Approach for Detecting Automated Spammers in Twitter (June 24, 2023). Mukt Shabd Journal Volume XI, Issue VI, JUNE/2022 ISSN NO : 2347-3150, pp. 49-53 , Available at SSRN: https://ssrn.com/abstract=4490635

[32] Vellela, Sai Srinivas and Pushpalatha, D and Sarathkumar, G and Kavitha, C.H. and Harshithkumar, D, ADVANCED INTELLIGENCE HEALTH INSURANCE COST PREDICTION USING RANDOM FOREST (March 1, 2023). ZKG International, Volume VIII Issue I MARCH 2023, Available at SSRN: https://ssrn.com/abstract=4473700

[33] Dalavai, L., Javvadi, S., Sk, K. B., Vellela, S. S., & Vullam, N. (2023). Computerised Image Processing and Pattern Recognition by Using Machine Algorithms.

[34] Vellela, S. S., Basha Sk, K., & Javvadi, S. (2023). MOBILE RFID APPLICATIONS IN LOCATION BASED SERVICES ZONE. MOBILE RFID APPLICATIONS IN LOCATION BASED SERVICES ZONE", International Journal of Emerging Technologies and Innovative Research (www. jetir. org| UGC and issn Approved), ISSN, 2349-5162.

[35] Vellela, Sai Srinivas and Sk, Khader Basha and B, Venkateswara Reddy, Cryonics on the Way to Raising the Dead Using Nanotechnology (June 18, 2023). INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS), Vol. 03, Issue 06, June 2023, pp : 253-257,

[36] Vellela, Sai Srinivas and D, Roja and B, Venkateswara Reddy and Sk, Khader Basha and Rao, Dr M Venkateswara, A New Computer-Based Brain Fingerprinting Technology (June 18, 2023). International Journal Of Progressive Research In Engineering Management And Science, Vol. 03, Issue 06, June 2023, pp : 247-252 e-ISSN : 2583-1062.,

[37] Gajjala, Buchibabu and Mutyala, Venubabu and Vellela, Sai Srinivas and Pratap, V. Krishna, Efficient Key Generation for Multicast Groups Based on Secret Sharing (June 22, 2011). International Journal of Engineering Research and Applications,Vol. 1, Issue 4, pp.1702-1707, ISSN: 2248-9622

[38] Kiran Kumar Kommineni, Ratna Babu Pilli, K. Tejaswi, P. Venkata Siva,Attention-based Bayesian inferential imagery captioning maker,Materials Today: Proceedings,2023,ISSN 2214-7853,https://doi.org/10.1016/j.matpr.2023.05.231.

[39] Venkateswara Reddy, B., &KhaderBashaSk, R. D. Qos-Aware Video Streaming Based Admission Control And Scheduling For Video Transcoding In Cloud Computing. In International Conference on Automation, Computing and Renewable Systems (ICACRS 2022).

[40] Reddy, N. V. R. S., Chitteti, C., Yesupadam, S., Desanamukula, V. S., Vellela, S. S., & Bommagani, N. J. (2023). Enhanced speckle noise reduction in breast cancer ultrasound imagery using a hybrid deep learning model. Ingénierie des Systèmesd'Information, Vol. 28, No. 4.

[41] Vellela, S. S., & Balamanigandan, R. (2023). An intelligent sleep-awake energy management system for wireless sensor network. Peer-to-Peer Networking and Applications, 16(6), 2714-2731.

[42] Rao, D. M. V., Vellela, S. S., Sk, K. B., &Dalavai, L. (2023). Stematic Review on Software Application Under-distributed Denial of Service Attacks for Group Website. DogoRangsang Research Journal, UGC Care Group I Journal, 13.

[43] Priya, S. S., Vellela, S. S., Reddy, V., Javvadi, S., Sk, K. B., & Roja, D. (2023, June). Design And Implementation of An Integrated IOT Blockchain Framework for Drone Communication. In 2023 3rd International Conference on Intelligent Technologies (CONIT) (pp. 1-5). IEEE.

[44] Vullam, N., Yakubreddy, K., Vellela, S. S., Sk, K. B., Reddy, V., & Priya, S. S. (2023, June). Prediction And Analysis Using A Hybrid Model For Stock Market. In 2023 3rd International Conference on Intelligent Technologies (CONIT) (pp. 1-5). IEEE.

[45] K. K. Kumar, S. G. B. Kumar, S. G. R. Rao and S. S. J. Sydulu, "Safe and high secured ranked keyword searchover an outsourced cloud data," 2017 International Conference on Inventive Computing and Informatics (ICICI), Coimbatore, India, 2017, pp. 20-25, doi: 10.1109/ICICI.2017.8365348.

[46] Sk, K. B., Vellela, S. S., Yakubreddy, K., & Rao, M. V. (2023). Novel and Secure Protocol for Trusted Wireless Ad-hoc Network Creation. Khader Basha Sk, Venkateswara Reddy B, Sai Srinivas Vellela, Kancharakunt Yakub Reddy, M Venkateswara Rao, Novel and Secure Protocol for Trusted Wireless Ad-hoc Network Creation, 10(3).

[47] Vellela, S. S., Sk, K. B., Dalavai, L., Javvadi, S., & Rao, D. M. V. (2023). Introducing the Nano Cars Into the Robotics for the Realistic Movements. International Journal of Progressive Research in Engineering Management and Science (IJPREMS) Vol, 3, 235-240.

[48] Kumar, K. & Babu, B. & Rekha, Y.. (2015). Leverage your data efficiently: Following new trends of information and data security. International Journal of Applied Engineering Research. 10. 33415-33418.

[49] Vellela, S. S., Reddy, V. L., Roja, D., Rao, G. R., Sk, K. B., & Kumar, K. K. (2023, August). A Cloud-Based Smart IoT Platform for Personalized Healthcare Data Gathering and Monitoring System. In 2023 3rd Asian Conference on Innovation in Technology (ASIANCON) (pp. 1-5). IEEE.

[50] Davuluri, S., Kilaru, S., Boppana, V., Rao, M. V., Rao, K. N., & Vellela, S. S. (2023, September). A Novel Approach to Human Iris Recognition And Verification Framework Using Machine Learning Algorithm. In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I) (Vol. 6, pp. 2447-2453). IEEE.

[51] Vellela, S. S., Vuyyuru, L. R., MalleswaraRaoPurimetla, N., Dalavai, L., & Rao, M. V. (2023, September). A Novel Approach to Optimize Prediction Method for Chronic Kidney Disease with the

Help of Machine Learning Algorithm. In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I) (Vol. 6, pp. 1677-1681). IEEE.

[52] Vellela, S. S., Roja, D., Sowjanya, C., SK, K. B., Dalavai, L., & Kumar, K. K. (2023, September). Multi-Class Skin Diseases Classification with Color and Texture Features Using Convolution Neural Network. In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I) (Vol. 6, pp. 1682-1687). IEEE.

[53] Vellela, S. S., Sk, K. B., & Reddy, V. An Intelligent Decision Support System for retrieval of patient's information.

[54] Rao, M. V., Sreeraman, Y., Mantena, S. V., Gundu, V., Roja, D., & Vatambeti, R. (2023). Brinjal Crop yield prediction using Shuffled shepherd optimization algorithm based ACNN-OBDLSTM model in Smart Agriculture. Journal of Integrated Science and Technology, 12(1), 710. Retrieved from https://pubs.thesciencein.org/journal/index.php/jist/article/view/a710

[55] Vellela, S. S., Narapasetty, S., Somepalli, M., Merikapudi, V., & Pathuri, S. (2022). Fake News Articles Classifying Using Natural Language Processing to Identify in-article Attribution as a Supervised Learning Estimator. Mukt Shabd Journal, 11.

[56] V. R. B, K. Basha Sk, R. D, N. Rao Purimetla, S. S. Vellela and K. K. Kumar, "Detection of DDoS Attack in IoT Networks Using Sample elected RNN-ELM," 2023 International Conference on Recent Advances in Science and Engineering Technology (ICRASET), B G NAGARA, India, 2023, pp. 1-7, doi: 10.1109/ICRASET59632.2023.10420193.

[57] E. S. R. R. Kumar et al., "UAVC: Unmanned Aerial Vehicle Communication Using a Coot Optimization-Based Energy Efficient Routing Protocol," 2023 International Conference on Recent Advances in Science and Engineering Technology (ICRASET), B G NAGARA, India, 2023, pp. 1-5, doi: 10.1109/ICRASET59632.2023.1042002