DESIGN OF DEEP CNN APPROACH FOR OPTIMAL WATER CONTROL USING IOT BASED WSN FOR SMART AGRICULTURE APPLICATIONS

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ABSTRACT

Recently in the field of agriculture, IoT based WSN had used for automated agriculture monitoringsystem utilizing numerous sensors. These sensors are positioned in the agricultural field to attain information abouthumidity, crops, rainfall, pesticides and irrigation systems. However, sensors have restricted processing, limited memory resources, less energy and transmission that may negatively impact yield from agriculture. Many researches had been performed using different application of IoT based WSN to solve these challenges. Hence, the present research is focused on designing an effective technique for optimal water controlin smart agriculture IoT based WSN to reduce over exploitation of water in cultivation land. The first stage is design of effective protocol for selecting accurate cluster head. The effective optimizationapproach CS-PSO is introduced by utilizing two optimization algorithms such as, cat swarm optimization (CSO) and particle swarm optimization (PSO). In the second stage, the collected data are preprocessed through log transformation along together with PCA coefficients. In final stage, DCNN technique are applied to predict the accurate water level in the cultivation field. Stimulation analysis on the proposed framework is carried out to estimate its performance. Several parameters such as, delay, accuracy, throughput, packet delivery ratio, error and precision are calculated for the proposed design. The throughput is 1.4 mbps and accuracy for proposed framework is 94% and this illustrate the effectiveness of the proposed model.

Keywords: *cluster head selection, IoT based WSN, CS-PSO, DCNN, smart agriculture, optimal water control*

1. Introduction

Recently, most of the industries using Internet of things (IoT) based Wireless Sensor Network (WSN) for controlling and monitoring devices at anywhere [1]. IoT makes an essential role in many area and it easily connect living things with devices. Today, an ordinary user can employ an adaptive nature of IoT that has changed [2]. Various approaches introduced by using IoT make convenient and life easier, such as automation, electronic healthcare domain, cities and electronic learning [3]. These techniques should not only be used to essential demands such as food from the agricultural fields but also to people's comforts [4]. The smart agriculture methods are totally differ from the traditional farming methods, todays many famers handle advance technologies and devices such as, smart tractors, hydroponic farming, drones and sensors based on field and plants to yield more productivity, these devices price are now at very low [5]. For agriculture there are a massive amount of water withdrawals. In agriculture there must therefore be additional precautions and debate. In fact, the profitability of agriculture is a major part of the scheme [6].

Agriculture that is effective or smart is one of the most advanced and well-organized approaches that will eventually lead to the adoption of IoT in the cultivation field [7]. [8] Smart agriculture may be defined as a development of the various technological breakthroughs that are capable of substituting trustworthy, efficient, and long-lasting contemporary technology with incompetent and inefficient conventional techniques. Intelligent agriculture supported by the Internet of Things comprises a large number of sensors that estimate different metrics such as crop data, soil and livestock, and weather [9]. Electronic devices, including as tablets, smart phones, and personal computers, are used to monitor the progress of the agricultural field monitoring process. These devices are connected to the internet. Farming on the Internet of Things (IoT) is becoming increasingly sophisticated, and cloud servers are storing information to aid farmers in making decisions about the protection of natural resources and the environmental status of water supplies [10-11]. The installation of an automated irrigation system helps to prevent both overuse and underuse of water resources on a farm. The overuse of water will result in poor water management and pollution of the

water supply. [12-13] Excessive water use may result in the development of harmful salts on the field's surface as a result of overwatering.
Therefore, a better water monitoring system is achieved in WSN. Various researchers had performed many research to develop the routing protocol in WSN (wireless sensor network) [14].Most of the existing IoT based protocols are designed based on artificial intelligence system and optimization algorithms. Several existing routing protocols related to WSN based smart agriculture for minimizing water over usage are, Supervisory Control and Data Acquisition(SCADA), Network Control System (NCS), Programmable logic control (PLC) and so on [15]. However, these existing routing approaches have several impact in automated irrigation system to reduce the over exploitation of water in cultivation land. To overcome the above declared concerns the irrigation system to reduce the over exploitation of water, this research focusing to design an effective routing protocol in the IoT network based model that can attained the optimal water control by monitoring and controlling the over usage of water.

Contribution of the Work

The main motive of this proposed framework is given as follows,

- To improve the production of the agricultural crops through the optimal water irrigation systemcan be achieved using IoT base WSN.
- To enhance autonomous monitoring of the crops for the determination of growth rate and to control the damage caused by the pests.
- To established a secure communication for the transmission of the sensor data.
- To improve and enhance the smart irrigation techniques by using DCNN approach.
- To perform the IoT based data collection in the cultivation field to monitor water control based on the need of the agricultural crops.

Organization of the Research

The continuing part of the research work is organized as follows: section 2 will includes the review of article related to various approaches in IoT based smart agriculture. Section 3 will include the background of proposed methodology. And section 4 will encloses the procedure of proposed framework. Section 5 will include the result assembled through implementation. Finally, section 6 will conclude the entire research work.

2. Literature Review

In recent years many scholars had designed various techniques related on IoT based WSNfor reducing the over exploitation of the water to yield better productivity. Some of the articles related to various approaches in smart agriculture based on IoT is reviewed as below.
Dobrescu*et al.* [16]had developed the context aware system that can monitor and enables the real time control through the IoT platform. This application is developed for controlling the irrigation process and the application is executed through the IBM Bluemix and an IoT platform. The purpose of this article is to assimilate three major techniques such as, Context awareness, Cloud computing and IoT in a multi-layer architecture for developing real-time progress control in smart agriculture. In addition, the author also used C# application performing in the client field access the control unit.These solutions are evaluated with an IBM BluemixIoT platform analysis application that automates an irrigation system by adjusting its controller parameters in context in response to environmental change.
Hariharr*et al.* [17]had designed a temperature sensing application for reducing labor, enhance farmer about the live condition of farm on the smart devices. This article the author analyzed various existing approaches to found several issues in IoT based smart agriculture. So, the author introduces the inefficient use of proper irrigational facilities results in low productivities by using IOT as well as GSM.With the click of the button it makes the process handy. In a simple temperature sensing application, we assess the performance of our approach. The crops can also dry up because of this uncertainty in the irrigation method. This approach has been observed to outperform existing conventional approach with regard to minimizing human efforts and facilitating irrigation.

Vaishnavi*et al.* [18]had developed an automated smart irrigation through the IoT network. The continuous monitoring of the field is established through the IoT technology based on cloud computing and the Raspberry pi microcontroller.The Internet of things provides several applications such as monitoring and selection of agricultural development, support for irrigation choices, etc. To automate and improve agriculture yield, a Raspberry-Si-based autonomous irrigation system is presented. The major objective of the programmed is to develop crops for minimal water use and the identification of automatic pests.The main benefit of this technology is to adopt cloud cloud-based precision agriculture which optimizes use of water, pesticides and improves crop yield.

Neha*et al.* [19]had designed a low cost smart automatic irrigation system, based on IoT framework for effective monitoring of the field for water control. Here, this article aims at developing a smart, low-cost irrigation system. It uses IoT to make components in the system for talking and connecting independently, with features such as, remote data monitoring, intelligent neural-based support decision making, one-time irrigation schedule estimation setup and the user interface administration mode. The outcomes of a proposed system, including the irrigation schedule, neural net decision making and remote information watching, have been selected to be presented in a sample crop test bed. The neural network gives the device the necessary intelligence that takes the current sensor information into account and masks the irrigation plan for efficient irrigation. The system that is being offered is useful for greenhouses, farms etc. because to its intelligence, low cost and portability.

Morteza*et al.* [20]had utilized and efficient innovation known as multi-intelligent control system (MICS) for management of water resource in irrigation. The cost effectiveness is the most important significant considered in the MICS system addition to employing the soft starter will reduce the mechanical stress. This research introduce a new technology for a water pump and pumping plant multi-smart control system(MICS) which is practically constructed, set up and operated in the farming sector. There are three control systems that complement the MICS main component, including the electrical pump control unit, the reservoir water level and the alert control system. The entire system is managed by IoT technology and can be operated from anywhere, via SMS or sound. A 4-state switch, which enables the system to function and work manually, automatically, using the IoT status and ultimately off-mode, was devised and used in the suggested control system. It has been determined that up to 60% of the water can be saved by using MICS via the IoT system, in addition to boosting the efficiency and productivity of the water management system.

Based on the above declared articles it is shows that the major issue faced in WSN based smart agriculture for reducing the water over usage. The main drawback of the system is that it require the integration of the control and monitoring system through a circulated framework that interconnects a few applications. The system is that the inadequate service and maintenance leads to system failure. So, the present research focused on IoT based WSN in smart agriculture. The brief explanation in proposed framework is given in the next section.

3. Proposed Methodology

Agriculture is the basic consideration for the living source of human species and agriculture is the important resource of any raw materials and food grains. Agriculture will decide the economy growth of any country. Many formers utilize the traditional techniques for farming still now, as the result gain low yield. Recently many farmers change their framing styles like smart agriculture to gain high yield. At that same time they meet various issues like wastage of fertilizers, water and etc. Most of the researches signifies the wastage of fertilizers and water such that field land requirements.But monitoring the field and environment factors are not completed and enough to improve the yield of the crops. There are number of factors that influence the gain of yield. To overcome these problems in this research, the requirement of water only supplied by each plants in the field. So we design a scheme for minimizing the over-usage of water in the cultivation if the crops. That is the reasonto reduce the wastage of water in the crops lands.The optimum water control is obtained by analyzing several parameters, such as moisture content in the soil, temperature, humidity and etc. The proposed architecture based on CS-PS optimization based Deep CNN for optimal water control is shown in figure1.

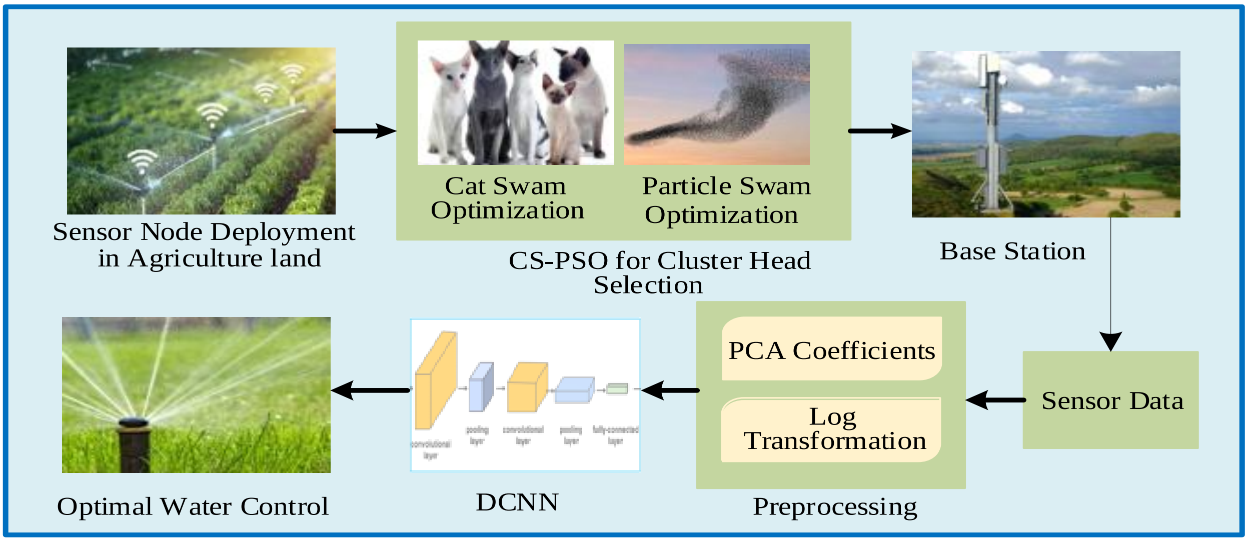

Figure 1: Architecture of proposed CS-PS optimization based Deep CNN for optimal water control

Figure 1 illustrates the proposed architecture. In the first stage of the proposed method is sensor node deployment, where the sensors are placed in separate location in the cultivation field. By using these sensors, several parameters are obtained such as, moisture content in the soil, temperature, humidity, age of the planets, height of the planet, size of the plant, level of the sunlight, type of the soil, number of the days the fertilizer is applied, total number of days after the application of fertilizer and total terms of fertilizer. After obtained sensor parameter, cluster head selection process takes place. Here, CS-PS optimization is utilize for selecting the cluster head. The proposed CS-PS based optimization will be introduced here with the help of the nature inspired optimizations, such as Cat Swarm optimization and Particle Swarm optimization. In the next stage, the sensor data are transmitted into the base station and the collected data are stored in the server. These data are collected from the agriculture field based on IoT. After that, the stored data are fed into preprocessing. The preprocessing of the collected data will be processing via the log transformation along together with PCA coefficients in order to make the data more productive for the water control. The preprocessed data which is given to the Deep CNN, which will perfectly trained the sensor data to predict the accurate water level in the cultivation field. Hence, the over-usage of the water is monitored and controlled in this proposed architecture. The following section is based on the step by procedure involved in the proposed methodology will be described in briefly.

4. Stepwise Process Involved In The Proposed Methodology

The proposed framework aims to attain an approach for minimizing the over-usage of water in the agricultural field lands. Nowadays, there are lot of research works based on agriculture related implementations such as, fertilizer related parametersand plant related parameters in addition with the weather related parameters in order to enhance the water management system in irrigation. Still several influences arise while monitor the water management system and the intelligent decision regarding the water control for the crop based on several sensitive parameters. Hence, this proposed framework introduces the CS-PS optimization and utilizes the Deep CNN techniques to overcome the challenges associated with implementing the optimal water control management system. The step by step procedure involved in the proposed framework will be briefly described as in the following.

4.1. Sensor Node Deployment

The initial stage of this proposed design is sensor node deployment. Farmland area of $100 \times 100m^2$is taken for our analysis. Totally 100 sensors are randomly deployed in the cultivation field, with in these sensors, sensor nodes and base station are included and each sensors are located into equivalent distance with 5m. The Transmission range for these sensor is around 30 m and each sensor node the energy range is 10 joules with the uniformly distributes farm land are $100 \times 100m^2$. From thesesensor nodes we can acquire several data related such as, humidity, moisture content and temperature, plant related parameters and fertilizer related parameters. The plant related parameters contain such as, age of the plant, weight of the plant and size of the plant. The fertilizer related parameters such as, number of days after the application of fertilizers, total terms of fertilizer application and number of days fertilizer these kinds of parameters are involved in fertilizer related parameters [21]. After completed sensor data acquisition, the optimizer which is used toselect the cluster head. In the following section will be briefly described about the optimization.

4.2. Process of Cluster Head Selection

From these sensor nodes, CS-PS optimization is used to selecting efficient cluster head. Each sensor node in the cultivation field, which transmits the acquired data individually to the sink node, hence transmitting the data to the sink node lot of energy will be wasted. To avoid such kinds of energy wastage, the sensor nodes are structured into a number of clusters. The cluster allocation is used to extend the sensor node network lifetime as well as reduce the energy wastage. Therefore, cluster head employed to control and monitor each sensor node. After that, cluster head directly communicate with the base station, if other node transmit data, which is sensed form the cluster head in that particular cultivation land**.** The distance between the node and base station can be estimated based on “received signal strength indicator”(RSSI) distance formula. The location of the deployed nodes can be tracked with the help of GPS tracking system. The distance between the sensor node and base station can be easily calculated if the base station gain, sensor node power and frequency are precisely.

4.2.1. Cat Swam Optimization

Cat swarm optimization is a cutting-edge optimization approach that is based on the intelligence of swarms. The CSO is based on the behaviour of cats, and it has two modes, which are tracing mode and seeking mode, respectively. The swarm is formed of an initial population of particles that must be found in the solution space. In this case, the cats serve as particles for resolving difficulties in CSO. When using CSO, each cates has a unique location comprised of velocity for each dimension, D dimensions, a fitness value, which indicates how fit the cat is, and a flag to indicate whether the cat is in searching mode or tracing mode [23]. The final result will determine which cat occupies the most advantageous position among the others. The next section will provide a high-level overview of the procedure involved in cat swarm optimization.

4.2.2. Particle Swam Optimization

Particle swarm optimization is one of the nature-inspired optimization approaches that has received a great deal of interest. In a PSO algorithm, a population of particles encourages the social behaviour of mammals, birds, and fishes by interacting with one another. The PSO has been utilized extensively in order to resolve the difficulties. This method's central concept is to optimise a problem by iteratively pushing a particle towards the optimum point in a specified search space[25]. The position update and velocity update functions are the two most important functions in the PSO framework. The following is a step-by-step description of the PSO algorithm's method.

4.2.3. CS-PS Optimization for Cluster Head Selection

Flawless routing between the cluster heads and the base station will be established utilizing the proposed CS-PS optimization based algorithm, which will be constructed with the help of the natural inspired optimizations, such as Cat Swarm optimization and Particle Swarm Optimization. The proposed CS-PS optimization will advantages to find the best cluster head. CS-PSO based cluster head selection approach to find the appropriate position for the head node.

4.3. Data Transmission from cluster head to BS

Each node send the data through cluster head, the cluster heads are positioned in the center of the cluster density. Hence, the cluster head covers all surrounding nodes easily. The best cluster heads are selected by utilizing CS-PS optimization in the above section. "After received data from each sensor node, the cluster head send the data to the base station". The base station (BS) will send data about the cultivation land related and plant related information which is stored in the server.

4.4. Sensor Data Collection

After completed data transmission from cluster head to BS, the data are stored in the servers which are collected by monitor the node information about cultivation process, before that the server data is subjected to preprocessing. The stored data which is collected to fed into the preprocessor. The following section will be describe based on the preprocessing as below.

4.5. Preprocessing

The node data is collected from the server in the BS, the data which is modified into the efficient format for this data preprocessing stage. Moreover, collected data are preprocessing through the log transformation along together with PCA coefficients in order to make the more productive for water control. The process involved in the preprocessing techniques will be described as follows.

4.5.1. PCA Coefficents

Principal component analysis (PCA) coefficients are used for the preprocessing techniques in order to make the data more effective. Generally PCA aims to reduce the size of the datasets to be compressed by keeping only this important information, data set description to be simplified and the structure of the variation and observation are also analyzed. IN PCA covariance matrix is utilized to estimate the PCA. Using PCA the redundancy of the data get extracted in order to achieve dimension reduction [26]. The procedure involves in the PCA dimension reduction technique will be explain as follows.

4.6. DCNN

Deep Convolutional Neural Network (CNN) reduce the number of parameters without losing on the quality of models to give and effective outcome. Deep CNN methods adapt for this research, it will intersecting to investigate the efficiency of the proposed CS-PS of its accuracy, throughput, delay and energy. The CNN architecture contain several layers such as, input layer, convolutional layer, pooling layer, fully connected layer and output layer. The convolution layer is used to extract data from the input layer, and it also has a number of different characteristics. In this case, the mathematical function of convolution is performed between the input layer and a filter with a certain size of M x M, as shown in Figure 1. When the filter is slid over the input layer data, the dot product between the filter and the sections of the input data that are proportional to the size of the filter is calculated (M x M). In additional instances, a convolutional layer is followed by a polling layer [28], which is then repeated. The deep CNN is depicted in the following figure 3

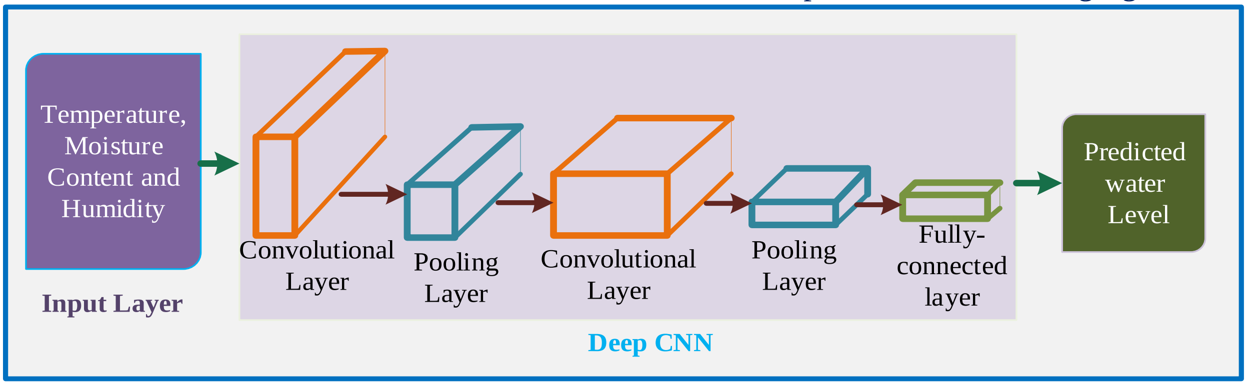

Figure 3: Deep CNN Architecture

The Deep CNN Architecture is shown in Figure 3. Reduce the size of the convolved feature map to save money on computations. This is the ultimate objective to achieve. Layer connections are minimized by executing depending on the polling layer and individually operating on each feature map. With the FC layer, connections between multiple layers may be made by using weights and biases as well as neurons. Before the output layer, these layers make up the final few of a CNN's design. The activation function is another critical component in the CNN model. In learning and approximating any continuous and complicated network relationship, they are employed. To put it another way, it determines which model information should be sent forward and which should not be sent to the network's end.

5. Result and Discussion

The proposed wireless sensor network based smart agriculture for optimum water control is tested on Mat lab software with the following system configurations

- Processor: Intel (R) Core ™ i5-3330s CPU @ 2.70 GHz
- Memory (RAM): 8.00 Gb (7.88 Gb usable)
- System type: 64-bit operating system, x64 based processor

The experimental analysis is carried out with the help of sensor nodes that are deployed within farmland area of $100 \times 100\ m^2$dimension and totally 100 sensors are deployed in the cultivation field and each sensor node have the energy range is 10 joules. Several stimulation parameters considered for the analysis is given in table 1.

Table 1: Simulation Parameters Considered For Analysis

Simulation parameter	Values
Type of channel	Wireless
Simulator	Mat lab R2020b
MAC type	802.11
Number of sensor nodes	100
Simulation time	30sec
X&Y dimension	100m&100m
Packet size	100 bytes
Packet rate	100 packets/sec
Energy	10 joule

Initially, the sensor nodes are deployed in the specified region of the agricultural area for sensing various information such as, plant related information, temperature and humidity. Entirely hundred sensors are deployed in the cultivation area. Figure 4 shows the node deployment in Agriculture Field. The nodes are deployed in random manner and no appropriate pattern is used for deployment. All the deployed nodes are static and they not in motion. Here, these deployed nodes are formed into each cluster, which is shown in the figure, each color represent separate cluster. In addition, the base station is located at the center of the cultivation area. In figure 5 shows the Cluster Head Selection in Agriculture Field. The cluster head are selected by using the proposed CS-PS optimization.The CS-PS based optimization is introduced with the help of cat swarm and particle swarm optimization. After selected cluster head, each node transmit the information into its specific cluster head and then the cluster head will send the acquired data into the base station and the data are stored in the server. The data for the analysis is collected from [34]. In addition, preprocessing will be done through log transformation along together with PCA coefficient. Here, deep CNN approach are adapt for predict the accurate information for optimal water control in the cultivation area.

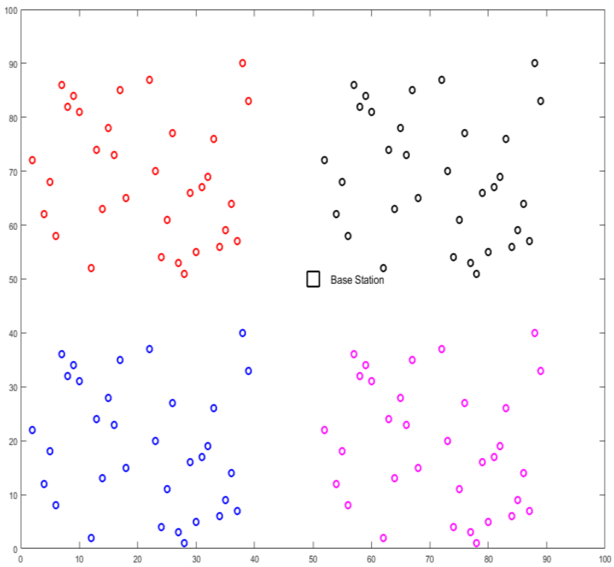

Figure 4: Node deployment in Agriculture Field

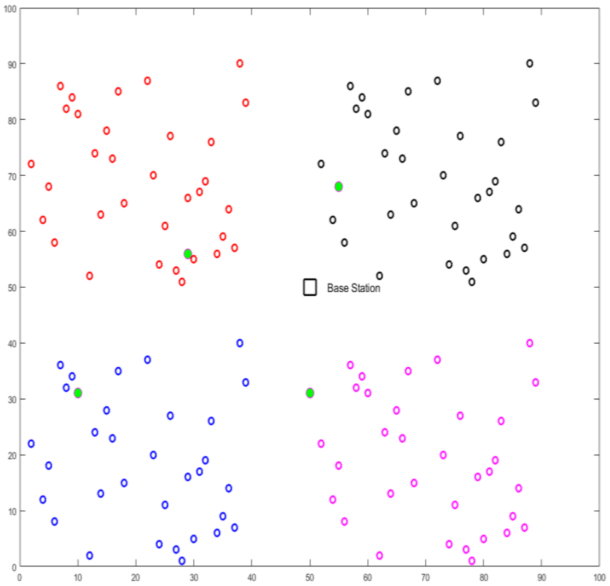

Figure 5: Cluster Head Selection in Agriculture Field

At last, the effective routing protocol in the IoT network based model attained the optimal water control by monitoring and controlling the over usage of water. To perform the experimental analysis on the proposed framework several performance factors are calculated. The estimation of various performance metrics relevant to the experimental analysis is describe in the following section.

5.1. Experimental Analysis

The experimental investigation on the proposed energy efficient approach was carried out using several metrics. The metrics that are considered for this study are accuracy, delay, error, packet loss, packet delivery ratio, precision, sensitivity and throughput. These parameters are estimated for the proposed framework and conventional wireless techniques in order to prove the optimal water control by using effective routing protocol in the IoT network. Several existing approaches based on wireless sensor networks are considered for comparison analysis such as, multi-intelligent control system for water management system (MICSWMS) [20], Water management system based on decision support system (WMSDSS) [25], Fuzzy logic Technique based smart agriculture (FLTSA) [30]. Some conventional approachesbased on data mining techniques also taken for this comparison analysis such as, Artificial Neural Network (ANN) [31], Naive Bayes (NB) [32]and Random Forests (RF) [33]. Table 2 demonstrates the parameter values estimated for the proposed and conventional techniques.

Table 2: Parameters Estimated for the Proposed and Conventional Approaches Based on Wireless Sensor Networks.

Performance Metrics	**MICSWMS**	**WMSDSS**	**FLTSA**	**Proposed (CS-PSO)**
Delay (sec)	0.39	0.43	0.46	0.35
Packet Loss (%)	0.15	0.2	0.25	0.09
Packet Delivery Ratio %)	0.87	0.8	0.75	0.91
Throughput (mbps)	1.3	1.25	1.1	1.45

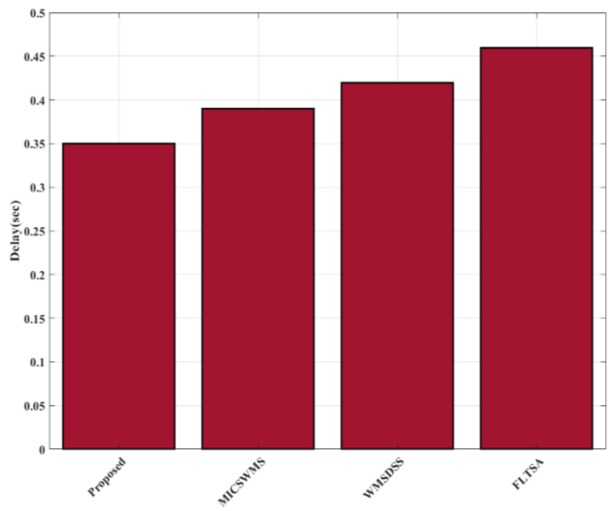

Figure 6: Comparison of Delay

The comparison of Delay (sec) among the proposed and existing wireless sensor networks based approaches are illustrated in figure 6. The graphical representation is based on the various wireless sensor networks techniques and value of delay in second on both X and Y labels respectively. The delay is determined to be less for the proposed wireless sensor networks method. The delay is found for the proposed method is 0.35 (sec) is less compared to existing methods. MICSWMS is found to be 0.39 (sec), WMSDSS is 0.43 (sec) and FLTSA is 0.46 (sec). The comparison of Packet Loss (%) between the proposed and existing wireless sensor networks based approaches are illustrated in figure 7. The graphical representation is based on the various wireless sensor networks techniques and value of packet loss in percentage on both X and Y labels respectively. The packet loss is determined to be less for the proposed wireless sensor networks method. The packet loss is found for the proposed method is 0.09% is less compared to existing methods. MICSWMS is found to be 0.15%, WMSDSS is 0.2% and FLTSA is 0.25%.

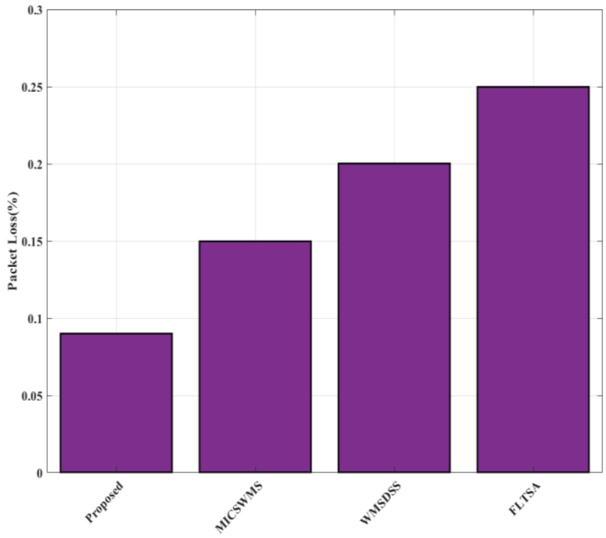

Figure 7: Comparison of Packet Loss

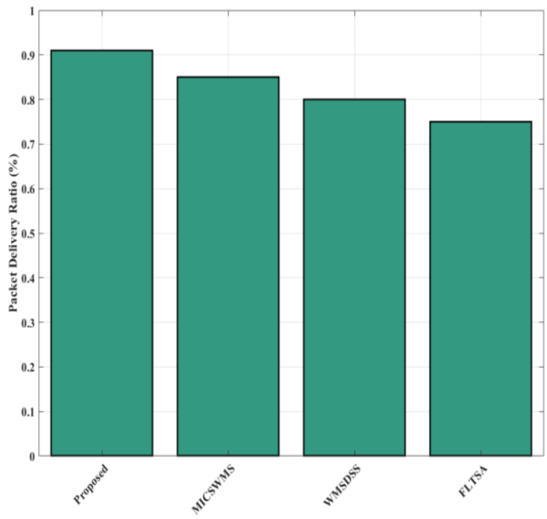

Figure 8: Comparison of Packet Delivery Ratio

The comparison analysis based on Packet Delivery Ratio (%) among the proposed and existing wireless sensor networks based approaches are shown in figure 8. The graphical representation is based on the various wireless sensor networks techniques and value of packet delivery ratio in percentage on both X and Y labels respectively. The packet delivery ratio is determined to be greater for the proposed wireless sensor networks method. The packet delivery ratio is found for the proposed method is 0.91 % is grater compared to existing methods. MICSWMS is found to be 0.87%, WMSDSS is 0.8% and FLTSA is 0.75%.The comparison analysis based on Throughput (mbps) among the proposed and existing approaches based on wireless sensor networks are shown in figure 9. The graphical representation is based on the various wireless sensor networks techniques and value of throughput in megabits per second on both X and Y labels respectively. The throughput is determined to be greater for the proposed wireless sensor networks method. The throughput is found for the proposed method is 1.45 %is grater compared to existing methods. MICSWMS is found to be 1.3%, WMSDSS is 1.25% and FLTSA is 1.1%.

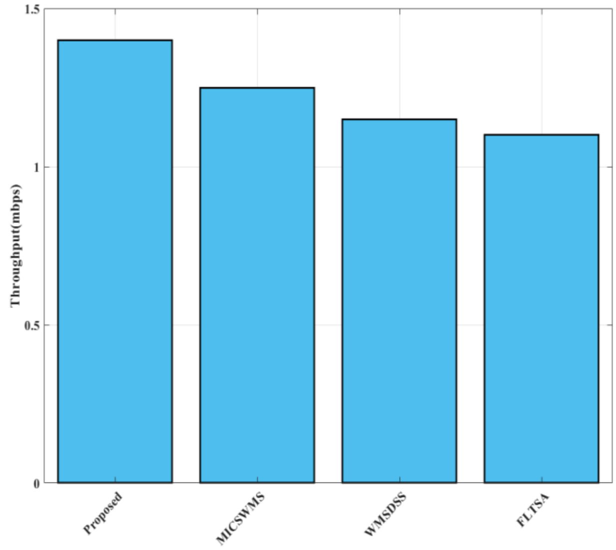

Figure 9: Comparison of Throughput

Table 3: Parameters Estimated for the Proposed and Conventional based on data mining Approaches

Performance Metrics	ANN	NB	RF	Proposed(DCNN)
Accuracy (%)	0.89	0.83	0.79	0.94
Error (%)	0.12	0.17	0.22	0.06
Sensitivity (%)	0.88	0.78	0.72	0.9
Precision (%)	0.82	0.71	0.69	0.89

The comparison analysis based on Accuracy (%) between the proposed and existing techniques based on data mining approach is shown in figure 10. The graphical representation is based on the various data mining techniques and value of accuracy in percentage on both X and Y labels respectively. The accuracy is determined to be greater for the proposed data mining method. The accuracy is found for the proposed method is 0.94 %is grater compared to existing methods. ANN is found to be 0.89%, NB is 0.83% and RF is 0.79%.The comparison analysis based on Error(%) among the proposed and existing techniques based on data mining approach is shown in figure 11. The graph is drawn between various data mining techniques and value of error in percentage on both X and Y labels respectively. The error is determined to be less for the proposed data mining method. The error is found for the proposed method is 0.06 %is less compared to existing methods. ANN is found to be 0.12%, NB is 0.17% and RF is 0.22%.

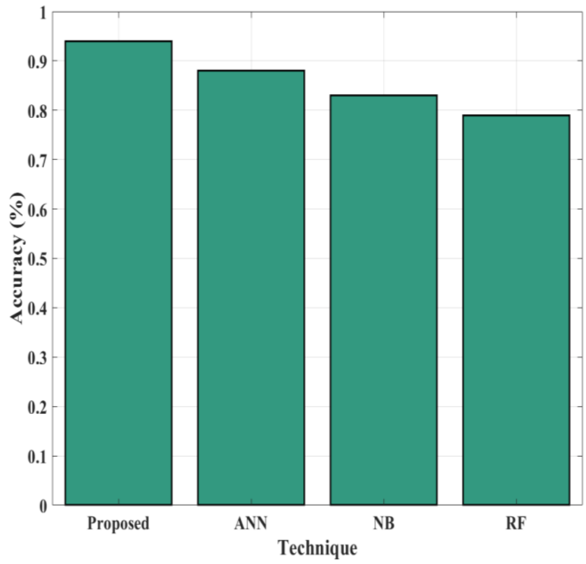

Figure 10: Comparison of Accuracy

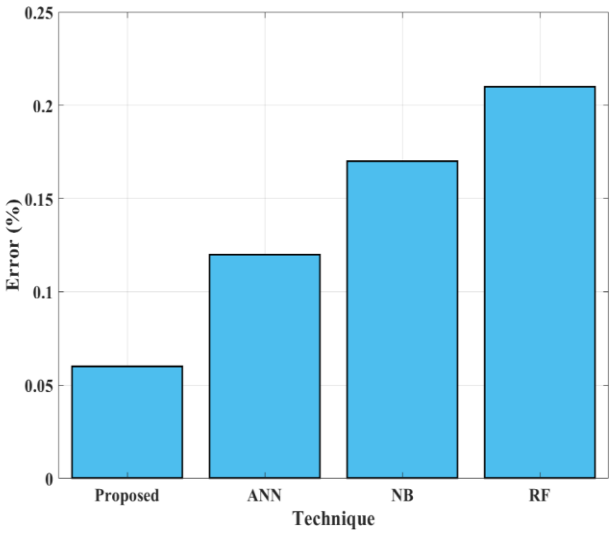

Figure 11: Comparison of Error

The comparison analysis based on Sensitivity(%) among the proposed and existing techniques based on data mining approach is shown in figure 12. The graph is drawn among various data mining techniques and value of sensitivity in percentage on both X and Y labels respectively. The sensitivity is determined to be greater for the proposed data mining method. The sensitivity is found for the proposed method is 0.06 %is grater compared to existing methods. ANN is found to be 0.12%, NB is 0.17% and RF is 0.22%.

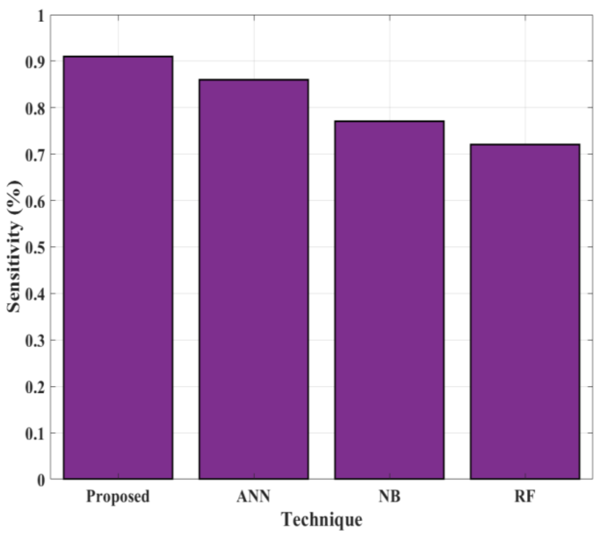

Figure 12: Comparison of Sensitivity

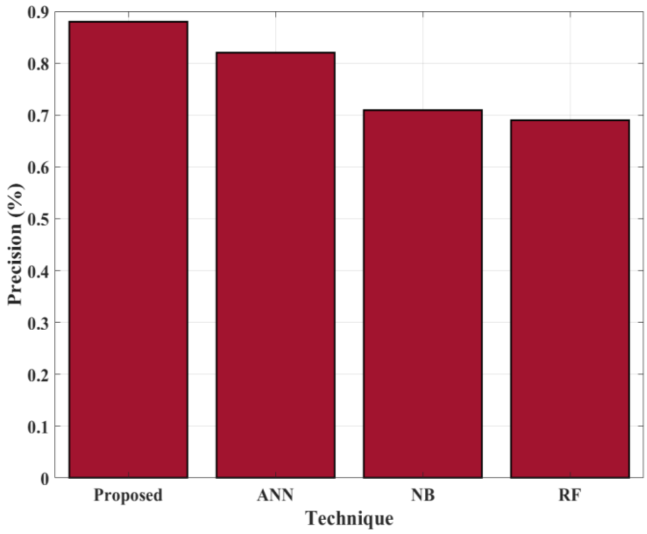

Figure 13: Comparison of Precision

The comparison analysis based on Precision (%) between the proposed and existing techniques based on data mining approach is shown in figure 13. The graph is drawn among various data mining techniques and value of precision in percentage on both X and Y labels respectively. The precision is determined to be greater for the proposed data mining method. The precision is found for the proposed method is 0.89 %is grater compared to existing methods. ANN is found to be 0.82%, NB is 0.71% and RF is 0.69%.This comparison analysis is shows that the performance of the proposed architectural framework is excellent on comparison to conventional techniques. By utilizing optimal water control design and enhanced wireless sensor network and improved data mining techniques can be achieved in the excellent way. The analysis shows that the enhanced wireless sensor network design is more suitable for smart agriculture for minimizing over usage of water can be controlled by utilizing water monitoring in irrigation through the IoT devices.

6. Conclusion

This research concentrates on designing optimal routing protocol for smart agriculture IoT based WSN to reduce the over exploitation of water in cultivation land to improve production yield. Nowadays due to the growth of advance technologies lot of automation and control system are invented, the cultivation techniques are become more modern instead of using traditional agriculture techniques. There are significant issues occur while monitoring and control the water management irrigation system in the smart agriculture. To improve the performance of IoT based WSN, an effective network model is designed in this current research utilizing cluster head based approach. The selection of cluster head is considered as important and it is done using CS-PSO algorithm. The sensed data from the node are transmitted into base station. In addition to send the information from node to sink with minimal energy consumption. After that, the stored data are taken for preprocessing with the help of log transformation along with PCA coefficient in order to make the data more productive for optimal water control. Moreover, effective prediction is done utilized DCNN.The experimental parameters are estimated and compared with several conventional wireless sensor networks as well as data mining approaches to achieve the excellent optimal water control functioning of the proposed framework.

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