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# Improvisation of Weather Monitoring System for Irrigation System using Two Fish Algorithm Comparing with Swarm Intelligence Algorithm

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## ABSTRACT

**Aim:** The main aim of the study is to improvise the weather monitoring for irrigation systems using Novel Two Fish algorithms. **Materials and Methods:** This system examines two groups such as Novel Two Fish Algorithm (N=10) and Swarm Intelligence Algorithm (N=10), results were compared based on accuracy of both the algorithms. Comparison of the significance level for Novel Two Fish Algorithm and Swarm Intelligence Algorithm having the significance value of ($p>0.05$). **Result :** The weather Monitoring System is done by using Novel Two Fish algorithms and achieved better results than Swarm Intelligence Algorithm. **Conclusion:** The results proved that the Novel Two Fish algorithms with DHT 11 sensor achieved higher accuracy than Swarm Intelligence in the irrigation System.

**Keywords:** Novel Two fish algorithm, Swarm Intelligence algorithm, Internet of Things, DHT 11 sensor, Arduino, Weather monitoring.

## INTRODUCTION

The importance of weather monitoring exists in many aspects. The weather conditions are required to be monitored to maintain the healthy growth in crops and to ensure the safe working environment in industries, etc. (Rani et al. 2020). The primary motivation behind taking up this project is the large utility of wireless weather monitoring in varied areas ranging from agricultural growth and development to industrial development (Benghanem 2016). The applications of this system deals with monitoring and controlling the environmental conditions (Sharma and Prakash 2021) like temperature, relative humidity (Okada 2011) and CO level with sensors and sends the information to the web page and then plots the sensor data as graphical statistics (Firouzi, Chakrabarty, and Nassif 2020). Using the internet from anywhere in the world, the updated data can then be accessed (Vermesan 2018).

There are 30 articles on Google scholar and 20 articles in search gate, in which the weather conditions of a field can be monitored from a distant place by farmers and won't require them to be physically present there in order to know the climatic behavior at the location by using wireless communication (Management Association and Information Resources 2020). Due to technological growth, the process of reading the environmental parameters became easier compared to the past(Leuning 2002). The system monitors the weather conditions and updates

the information to the web page (Lakshmi, Lavanya, and Babu 2017). The reason behind sending the data to the web page is to maintain the weather conditions of a particular place that can be known anywhere in the world (Siddiqui et al. 2021). The system consists of a Temperature and Humidity sensor(Houdas and Ring 1982). The main application of sensor based systems are used in IMD (India Meteorological Department) for weather forecasting (Vasquez 2006). All sensors can measure the corresponding weather parameter (Kulshrestha 2013). The system is intended to be used in hill stations, large residential buildings and manufacturing industries (van Driel, Pyper, and Schumann 2019). The system is included with a microcontroller to process all the operations of the sensors (Borhade 2018). Water shortage is now influencing a piece of the world and the circumstance is deteriorating over the long run because of the expanding total populace and new water requests (van Driel, Pyper, and Schumann 2019; Font, Kōrtösi, and Farkas 2004).Previously our team has a rich experience in working on various research projects across multiple disciplines(Ezhilarasan et al. 2021; Balachandar et al. 2020; Muthukrishnan et al. 2020; Kavarthapu and Gurumoorthy 2021; Sarode et al. 2021; Hannah R et al. 2021; Sekar, Nallaswamy, and Lakshmanan 2020; Appavu et al. 2021; Menon et al. 2020; Gopalakrishnan et al. 2020; Arun Prakash et al. 2020)

The horticulture area, especially the water system, burns-through a significant bit of the freshwater. Research gap with the existing method is the requirement of the improvisation of the weather monitoring systems. The main aim of this work is to improve the weather monitoring system for irrigation systems using a Novel Two Fish algorithm and to compare it with Swarm Intelligence Algorithm.

## MATERIALS AND METHODS

The project was done in the Cloud Computing Laboratory, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences. This proposed work involves two groups for the weather reporting system. The first group is two fish algorithms and the second one is the swarm Intelligence Algorithms (Siddiqui et al. 2021; Dhiman et al. 2021) tool by using Internet of things concerning the innovative weather monitoring system. Each group consists of 10 samples with an overall sample size which are calculated by using previous study results, in kaggle.com by keeping threshold 0.05% G Power 80%, confidence interval 95%, and enrollment ratio. Feature extraction is done and tabulated (Altman et al. 2013).

The temperature and humidity dataset collected from Kaggle needs to be processed before applying it to the internet of things model (Altman et al. 2013; Jørgensen and Carstensen 2010). The processed dataset is given for training and testing. Data processing includes missing data removal, replacement of null values with mean or median values, and standardization of data. The preprocessed dataset with features is given as input to the Arduino Uno. 70% of the data is given for training from the total sample size for training and the remaining 30% is given for testing (Altman et al. 2013; Jørgensen and Carstensen 2010; Shen et al. 2021).

### Internet of Things

The World Wide Web needs to have one client – server configuration for communication. Its client needs to be connected to the server with its IP address which can be universally accessible. The GPRS module at a certain period of time updates the information to the web page through the server. The system is equipped with all sensor devices and should act as a client to send the data to the web server. For establishing a connection between the sensor network and the internet, we used a GPRS module as an additional communication interface controlled by the microcontroller. A GPRS module requires a source of internet connection with the help of a SIM card. Once configuring the GPRS module with an internet source, it acts as a client and sends the sensor data retrieved by the microcontroller and we can access it from anywhere using the internet. The idea of connecting all the sensors to the internet is the Internet of Things (IoT).

The traditional technologies like home automation, wireless sensor networks and control systems will become more efficient and smarter due to the involvement of IoT. IoT has a wide range of application areas. Such as Medical applications for monitoring the health of a patient and sending the information wireless. The present developing Wearable instrumentation is also based on IoT. The example wearable instrumentation is Smart wristbands, navigation pills, etc (Zhang and Liang 2017). All the methods require an internet interface to update the health info or to control the device with a smartphone. The IoT also plays a vital role in media applications for advertising and exchanging the information worldwide. The manufacturing processes also require IoT for supply chain management, digital control systems for monitoring the manufacturing processes. The space

requirements of IoT technology, the geographical specifications are always important in the case of tracking applications.

The geographical dimensions of objects is also important while obtaining the data from the objects. IoT in automobile applications and traffic maintenance became the most used area of automation. The automated devices in a vehicle should be connected to a cloud to update the car health within a period of time. By connecting the vehicles and traffic signaling systems to the internet, people can easily find the shortest path for their destination from the traffic monitoring systems and can navigate automatically by checking all other directions.

**Arduino UNO tool using in weather monitoring system**

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header (Monk 2011). It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

**Two Fish Algorithm**

Here the twofish algorithm (method) is imported from the python library which characterizes the encryption work tfencrypt(). This capacity acknowledges 3 arguments: infile, outfile and password. The infile is read as plaintext and it is cushioned with an exceptional person to guarantee that its whole length is a multiple of the bs, which is the expected square size. The '%' image is used yet it tends to be anything exceptional and unique in relation to the remainder of the plaintext. The cipher T is then defined by calling the capacity TwoFish() and providing a password in bytes as an argument. The plaintext is scrambled at last in similarly sized lumps or parts and saved to the disk as the outfile. The item outfile will have encoded ciphertext after this function executes. The decryption function tfdecrypt() is defined, essentially which does the encryption process in reverse. The infile, outfile and the password are provided, as before. The infile is the encoded document that contains the ciphertext. The decryption makes this in chunks or portions of equivalent size as before with our password and makes a point to eliminate any padding from the last piece that was embedded during encoding . The whole decrypted plaintext is composed of the outfile. At the point when this capacity executes, the outfile will have the unique, decoded plaintext. Here in this proposed work, this two fish algorithm is used to send the encrypted data from the arduino that is taken from the DHT sensor and the decrypted data is shown in the data.

**The Twofish Encryption Algorithms**

1. Sensor data is fed into the function as Two 32-bit words.
2. Each word is broken up into 4 bytes, then sent through four key-dependent S-boxes. These S-boxes have 8-bit I/O.
3. The Maximum Distance Separable (MDS) matrix combines the 4 output bytes into a 32-bit word.
4. The two 32-bit words are combined using a PHT.
5. In the subsequent step, they are added to two round subkeys and XORed into the right half.

**Swarm Intelligence Algorithm**

Swarm Intelligence algorithms are decentralized, self-coordinated algorithms used to determine complex issues with dynamic properties, inadequate data, and restricted calculation capacities. We present the current multitude insight based calculations with their primary applications, then, at that point, we present existing IoT-based frameworks that utilize SI-based calculations.Anyway with the variety of advances utilized in IoT based frameworks, for example, various conventions and information models, numerous clients of different web associated gadgets face high integration and maintenance costs while carrying out enormous IoT projects. Swarm Intelligence could be a decent contender to determine this disparity. Characterized as the aggregate conduct of decentralized, self-coordinated systems, Swarm Intelligence can enable a collection of multiple IoT devices to work together and exchange information, thereby achieving greater utility. With such coordinated

effort, the "group" intelligence can even assist with accomplishing a definitive objective of an "Internet Of Things" (IoT), where people, processes, data and things are all connected.

Swarm Intelligence can link up everything from our smart TV to our smart doorbell, light bulbs and appliances in our home to create a connected “community”. The Swarm Intelligence-based algorithms are used to achieve a universal optimisation not just inside the house but also outside while the users are out and about, enabling all of the devices to communicate with each other and the user via alerts on their smartphone. In this project this swarm intelligence is used to get the weather details to communicate to the device from arduino.

**Statistical Analysis**

Statistical analysis is done by the software named IBM SPSS Statistics 26. Google collab is used for simulation & verification. Independent variables required for analysis are the value of shares & its capacity, dependent variables are profit per share. The analysis is done by comparing the accuracy rate of the two fish algorithm and the swarm intelligence algorithm. Independent T-test analysis is carried out in this research work.

## RESULTS

Table 1 and Table 2 represents data collected from samples of the dataset for the innovative weather monitoring system using the Arduino Uno tool to gain accuracy (%) for Two fish algorithm and Swarm Intelligence.

$$\text{Accuracy} = TP + TN / TP + TN + FP + FN \quad (1)$$

where, TP = True Positive TN - True Negative FP - False Positive FN - False Negative Loss: A scalar worth that endeavor to limit during our preparation of the model. The lower the misfortune, the nearer our expectations are to the genuine names. The IBM SPSS version 21 statistical software is used for our study. The independent variables are shape and size and the dependent variable is accuracy (%). for our study of the Weather monitoring system. In SPSS, the datasets are prepared using N= 20 as the sample size for the historical data is given as a grouping variable, and accuracy is given as the testing variable.

Group Statistics is applied for the dataset in Statistical Package for the Social Sciences (SPSS). Table 3 shows the comparison of the accuracy Novel Two Fish algorithm of the Swarm Intelligence Algorithm. The mean accuracy using novel Two fish algorithm with DHT 11 sensor gives significantly better than the Swarm Intelligence.

Table 4 represents the Independent Sample T-Test that is applied for the sample collections by fixing the level of significance as ($p > 0.05$) and confidence interval (CI) as 95 % and comparing the two algorithms.

Figure 1, shows the comparison of the Novel Two Fish algorithm with the help of Arduino UNO and Swarm Intelligence in terms of mean accuracy. The mean accuracy of 96.3% for the Novel Two fish algorithm which is better than the swarm intelligence gives the accuracy of 94.5% . X-Axis: two fish algorithm and Swarm Intelligence algorithm and Y-Axis: mean accuracy with SD +/- 2 SD.

## DISCUSSION

The research work observed that the Novel Two fish algorithm proved better than the Swarm intelligence algorithm. It has been observed that the Novel Two fish algorithm achieved accuracy as 96.3 which is significantly better than swarm intelligence with the accuracy of 94.5 in predicting the temperature and humidity using novel weather monitoring systems.

Similar findings related to this paper define a Design and Implementation of Weather Monitoring and Controlling System used for controlling the devices as well as monitoring the environmental parameters (Susmitha and Sowya Bala 2014) . A network structure of automatic weather stations based on Internet of things technology is constructed to realize the independent operation of intelligent sensors and wireless data transmission (Shi 2019). Research on networking data collection and dissemination of meteorological data, through the data platform for data analysis, the preliminary work of meteorological information publishing standards, networking of meteorological information receiving terminals provides the data interface, to the wisdom of the city, the wisdom of the purpose of the meteorological service. (Ma and Qu 2020). The IoT automatic station is an automatic weather station based on the Internet of things, which fully embodies the real-time data interoperability, data fusion and other characteristics of the IoT technology (Feng 2015).

Temperature and Humidity is captured by a sensor and it is transferred to cloud servers through wired or wireless networks either using Twofish algorithm or Swarm Intelligence algorithm. In swarm Intelligence, each sensor node as it is transferring the information to the cloud server, the transferred data is not a secured one. In the twofish encryption algorithm it is optimized to have a 32 bit symmetric key for a block size of 128 bit sensor data using block cipher. It may vary 128 / 192 / 256. As decoding is in standard form, the description is less complicated.

The limitations of the weather monitoring system using arduino with the help of ESP8266 microprocessor consumes more power than usual, the input data have to be given manually and it takes time. In future, this would be overcome by implementing sensors, microprocessors, and microcontrollers in circuit design. The outcome of the arduino is more significant, efficient than the microcontroller with more accuracy.

## CONCLUSION

This paper estimates that the implementation of a weather monitoring system shows that the Novel Two Fish algorithm appears to have lesser accuracy than the swarm intelligence. The Novel Two Fish algorithm weather monitoring system appears to perform significantly better than the swarm intelligence algorithm weather monitoring system.

## DECLARATIONS

### Conflicts of Interest

No conflict of interest in this manuscript.

### Author's Contribution

The author K. Dinaprasad Reddy was involved in data collection, data analysis, and manuscript writing. The author BNS was involved in conceptualization, data validation, and critical review of the manuscript.


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## TABLES AND FIGURES

**Table 1**. Weather monitoring system temperature and Humidity by Ardunio and DHT 11 sensor using Two fish algorithm.

| DHT 11 | Temperature | Humidity |
|---|---|---|
| Sample 1 | 25 | 44 |
| Sample 2 | 32 | 48 |
| Sample 3 | 44 | 52 |
| Sample 4 | 38 | 55 |
| Sample 5 | 33 | 47 |
| Sample 6 | 35 | 54 |
| Sample 7 | 36 | 56 |
| Sample 8 | 40 | 55 |
| Sample 9 | 29 | 49 |
| Sample 10 | 31 | 50 |

**Table 2**. Weather monitoring system temperature and Humidity by Arduino and DHT 11 using Swarm Intelligence.

| DHT 11 | Temperature | Humidity |
|---|---|---|
| Sample 1 | 24 | 40 |
| Sample 2 | 40 | 45 |
| Sample 3 | 30 | 50 |
| Sample 4 | 45 | 54 |
| Sample 5 | 24 | 44 |
| Sample 6 | 49 | 51 |

| | | |
|---|---|---|
| Sample 7 | 30 | 48 |
| Sample 8 | 53 | 50 |
| Sample 9 | 30 | 48 |
| Sample 10 | 45 | 46 |

**Table 3.** Comparison of the accuracy Novel Two Fish algorithm of the Swarm Intelligence Algorithm. The mean accuracy using novel Two fish algorithm with DHT 11 sensor gives significantly better than the Swarm Intelligence.

| **Accuracy** | **N** | **Mean** | **Std.Deviation** | **Error** |
|---|---|---|---|---|
| Novel Two Fish Algorithm | 10 | 96.31 | 9.56614 | 3.02508 |
| Swarm Intelligence | 10 | 94.51 | 10.65624 | 3.36980 |

**Table 4.** Independent Sample T-Test is applied for the sample collections by fixing the level of significance as (p> 0.05) and confidence interval (CI) as 95 % and comparing the two algorithms.

| | | **Levene's Test for Equality of Variances** | | **T-test for Equality of means** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **F** | **Sig** | **t** | **dif** | **Sig (2-tailed)** | **Mean Difference** | **Std Error Difference** | **95% Confidence Interval of the Difference** | |
| | | | | | | | | | **Lower** | **Upper** |
| Temperature | Equal variances assumed | 63 | .43 | 1.06 | 18 | <.001 | 4.80 | 4.52 | -4.71388 | 14.3138 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal variances not assumed | | | 1.06 | 17.79 | <.001 | 3.40 | 4.52 | -4.72176 | 14.3217 |
| Humidity | Equal variances assumed | .11 | .43 | 1.89 | 18 | <.001 | 4.80 | 1.79 | -.37387 | 7.17387 |
| | Equal variances not assumed | | | 1.89 | 17.99 | <.001 | 3.40 | 1.79 | -.37388 | 7.17388 |

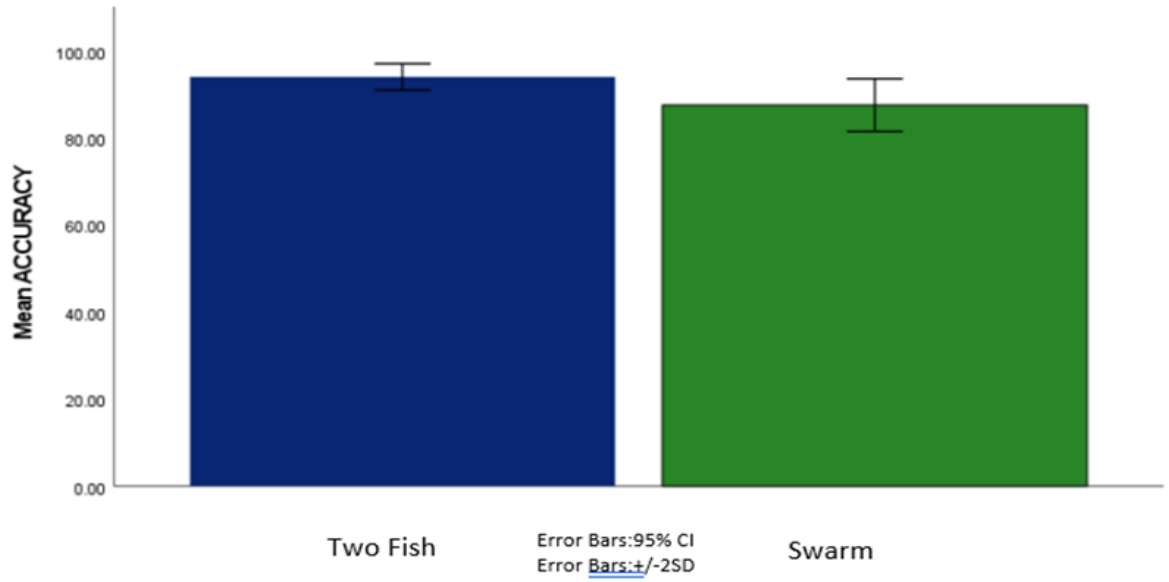


**Fig. 1.** Comparison of Novel Two Fish algorithm with the help of Arduino UNO and Swarm Intelligence in terms of mean accuracy. The mean accuracy of 96.3% for the Novel Two fish algorithm which is better than the swarm intelligence gives the accuracy of 94.5% . X-Axis: two fish algorithm and Swarm Intelligence algorithm and Y-Axis: mean accuracy with SD +/- 2 SD.