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Particle Swamp Fuzzy Analytical Hierarchical Process (PSFAHP) for Arthropoda in a control condition

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ABSTRACT

The migration of hatched PSL towards the proper location of food in the shape of a group and the suitable environment for the PSL in which important chemicals and nutrients are required for their growth are the two key elements that affect the PSL's birth and mortality rate. The first phase of this study used particle swamp optimization, which is closely connected to particle (PSL) movement toward the objective or search space, which in this case is a sea, river, or control conditioned pond. These PSLs move with a specific velocity from their original position to the appropriate position for a better quality of life. Cost, population, learning coefficients, and particle global are all connected elements that influence PSL movement decisions. Cost, population, learning coefficients, particle global position, particle current location, updated PSL location, and particle velocity are all connected aspects that influence PSL movement decisions. Once the particles have communicated and migrated to their ideal place, they learn the path, timing, and velocity. Once the PSLs have arrived at their ideal location, several factors such as salinity, dissolved oxygen, nutrient food, and so on are involved. These two algorithms will show the PSL's death and birth rates. They will work together to defend the environment in the future. The following are the details of the algorithm. This study is hindering grisly exacerbates by curbing the core irrefutable factors like undesirable chemicals, degraded environment.

1. Introduction.

Intelligence depicts diametric understanding based on contemplated environmental facts to get colossal for robust understanding. This study is utilizing various irrefutable facts that are causing adverse effects on the life of (PSL), which deprived aquamarine life by vexing exacerbation, in curtail, it's on the verge after that Food and Agriculture Organization (FAO), Worldwide Fund (WWF) will invest an immense amount of money on rehabilitation of aquamarine. Once time has passed the dreaded, disrupted factors will immerge that will ruin the PSL life cycle solely. This research aims to address the following questions and the research questions are as follows:

(i) Is there any way through which PSL growth is monitored 24x7 or the study can decrease the mortality rate of PSL?

(ii) Is there any way to do pH sensing in the control condition to maintain water quality?

(iii) Is there any Artificial Intelligence (AI) model that can sense water temperature, food, chemical, and dissolved oxygen?

(iv) Is there any possibility to get real-time results using AI? The PS optimization uses a stochastic method to move a particle from a generic place to an ideal location through communication and learning while keeping a constant velocity. The death and birth model of PSL will increase as a result of PSO, and FAHP will ensure that the aforementioned environment is optimal for their growth rate. In sum, it's a win-win situation for the environment and PSL, and the farmers will benefit finan-

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cially. Any particle's principal goal is to look for and obtain the best space with a specific velocity to achieve its goal. Further FAHP is divided into four main factors a) Formulation of a said problem b) Incisiveness of the facts using mathematical-based comparison, vindicated or consistency facts check, deep analysis using primitive irrefutable correlated facts. The equation of FAHP is as follows for reference:

$$A=\begin{bmatrix} 1 & 0\ldots 0 & \Re_1 \\ 0 & 1 \ddots\ 0 & \Re_2 \\ \vdots & \ddots\ \ \ddots 0 & \vdots \\ 0 & \ldots 0..1 & \Re_n \\ \frac{1}{\Re_1} & \frac{1}{\Re_2}\ldots\frac{1}{\Re_n} & 1 \end{bmatrix}$$

The posed system is something that performs complex logical drudgery based on thirteen non-cohort factors like nutrient food, water, conducive environment, and pertinent chemicals which improves PSL fecundity, and decreases the rate of mortality, in curtail unabated condition may perspire results to the PSL farmers.

A. PSL Taxonomy:

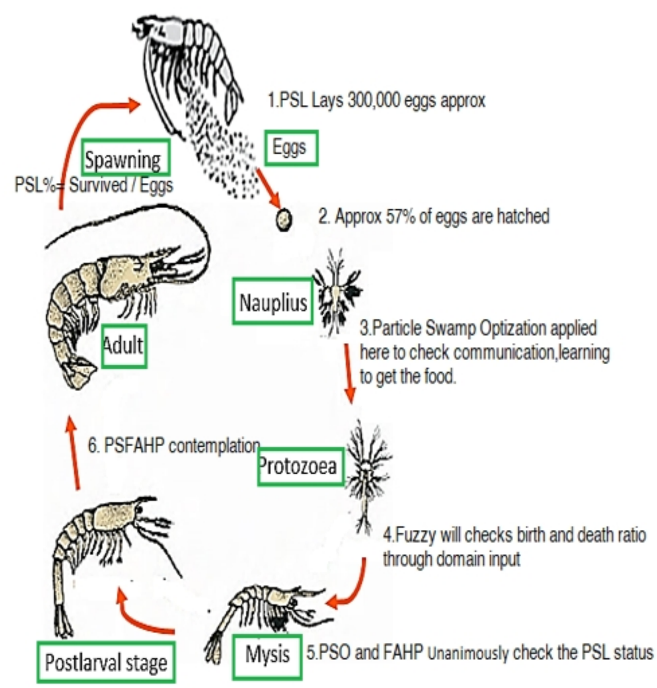
Prawn lies in the Malacostraca class whose order is Decapoda with penaidae family, further its pénaéïdes of penaid shrimps, in other words, penaeus of the genus whose specie is penaeus mondon [1]. FAO stats depict the PSL catches has been declined as a ratio from 5 to 1 for many years, and the reason behind this malleability is computerized fish trawlers, toxic waste detrimental effects, in other words, the aquamarine scientist has succumbed and they are looking for an innovative idea that can hinder such depriving, debilitating effects [2].

B. Nutrients for PSL:

One of the essential nutrients for PSL growth is Carbon 'C', then molasses of sugarcane or molasses of sweet potato helps PSL to grow, moreover combination of rice bran and cassava is good for salubrious growth. In curtail aforementioned bio-floc plays an eminent role in PSL survival, and vivacious growth [3]. Eminent scientist Ngoc Hai did some experiments and conclude that PSL population growth is correlated with genetic diversity means disparities and similarities in PSL genes, in other words, his study depicted that DNA, RNA, and chromosome similarities and dissimilarities will change the population of PSL, and another important factor is a conducive environment for PSL like balanced aquamarine diversity [4][5][6]. Healthy nutrients like seaweeds a type of grass on the sea bed is enriched with all essential nutrients for PSL [7][8][9]. Feeding time, nutrient food, water temperature, and PSL growth pattern monitoring is other aspects for the resurrection of normal PSL growth [10][11][12]. There is no danger for PSL once the government curbed the catches, process industrial waste, domestic government will take incumbent action against the timber mafia who are responsible to cut mangroves trees [13][14]. World renown scientist Thomas Malthus has addressed the food supply chain with the population using a graph, it states reproduction should be curbed [15][16][17]. Furthermore, only 58% of PSL eggs are hatching, so the researcher must improve the hatchery rate by doing the right action at right time [18][19][20].The following cycle designed by author.

C. The PSL Life Cycle:

Figure 1: Particle Swamp Fuzzy Analytical Hierarchical for PSL.



Source: Authors.

2. Related Review Papers.

This research aims to address the following questions and the research questions are:

(i) Is there any way through which PSL growth is monitored 24x7 or the study can decrease the mortality rate of PSL?

There is a list of sensors that can provide their results for the processing units for contemplation and assimilated results, those parameters that lagged will be shown by AI FAHP . For better results this study has rented a xylem brand sensor named EXO2 multi-parameter water quality sonde with 6 sensor ports & 1 wiper port, 10m vented level sensor whose ID is "599502-04", this product has a USB port and it provides the actual data 24x7 to the processing unit.

(ii) Is there any way to do pH sensing in the control condition to maintain water quality?

The aforementioned sensor can check pH using another separately placed sensor.

(iii) Is there any Artificial Intelligence (AI) model that can sense water temperature, food, chemical, and dissolved oxygen?

The prototype is for the resurrection of PSL so this model is based on FAHP which inclusively checks all the variables and provides the consolidated result based on robust computation. These results are providing an obvious remedy for an insurmountable toxic environment.

(iv) Is there any possibility to get real-time results using AI? Indeed our prototype is providing real-time recapitulate, mesmerizing results by analyzing plethoric data succinctly[21]. The analytical hierarchical process is comparatively simple, following multi-criteria for colossal results based on ranked data, the worst part is input data increased time complexity will also increase with deep contemplation provided by enormous computation. The researcher depicts the complexity as about O (mn^2, m^2n, whereas 'm' depicts alternates which is nine in number, 'n' depicts provided criteria [29]. For colossal results any system requires the best sensor, this study is utilizing an EXO sensor, its role is to address the following factors a)pH b) Salinity c) Temperature d)Algae e)clear water f) dissolved oxygen, all these results are provided to FAHP for contemplation because it's simple, and provide complex results to the farmers. EXO is succinct its error ratio is from 6.1% to 9.6%, on average it's 7.2%, in curtail in general its accuracy is about 89% and take less time. In other words, FAHP is consuming less time and sensors are also taking less time means a smart system that can decide on its own in less amount time[22][23]. Pallavi Dutta has performed a drudgery act in West Bengal in which her study supports Bio-floc system because it's a lucrative business in the said vicinity, later this study forecast the facts using (NAR) model Non-linear Auto-Regressive after performing data curation, the input data was of thirty-six years, and then aggregates the detrimental effect and Morbidity which will result in 2050 as a dreaded blow for all of us [24].

Vietnam is famous for its seafood, unfortunately, now its delta Mekong is suffering from three diseases Enterocytozoon hepatopenaei, acute hepatopancreatic necrosis, and white spot syndrome disease. This disease spread was highlighted by the GIS system, later integrated with (ML) Machine learning for accurate prediction. In curtail, this study has counter shrimp disease near Mekong delta using GIS technology to reduce the grisly exacerbates which may cause a slump in Vietnam exports [25][26]. Researcher Umar Farouk has introduced a new concept in which its research has utilized modern tools like robots, sensors, drones, macro, and micro-sensors, the energy-efficient algorithm is utilized in it to overcome the power issue and provide round the clock support to humans that can reduce farmer's efforts. This study has coined it as CIA means cloud-based computing by the Internet of things using Artificial Intelligence support [27]. Australian researchers have put their marvelous efforts to mitigate disparities by employing machine learning core algorithms like (SVM) Support vector machine, (NN) Neural Network, (KNN) K-nearest mean neighbors, (RA) Regression Analysis, (DT) Decision Tree, (GNB) Gaussian Naïve Bayes, (RF) Random Forest, and AdaBoost.

E. RESEARCH GAP:

Aquamarine life is on feral edge, after that logical drudgery cannot hinder detrimental effects on (PSL). This study research gap begins with 2021 research conducted by famous Indian researchers Dr.Pallavi Dutta, and her area of research in West Bengal supports Bio-floc, proved her research by (NAR) model Non-linear Auto-Regressive model [24].

Later Vietnam researchers are focused on the lucrative business of Prawn but didn't overcome the three said diseases, but their research has segregated the area via GIS which is integrated with a machine learning algorithm. Vietnam exports are suffering badly due to this disease [25][26].

Furthermore, another researcher named Umar Farouk has used (CIA) means cloud computing linked with the Internet of things and plethoric computation by algorithms of Artificial Intelligence [27].

In 2021 a researcher has applied three factors salinity, dissolved oxygen, and water temperature on the amalgam of Machine Learning algorithms like (SVM) Support vector machine, (NN) Neural Network, (KNN) K-nearest mean neighbors, (RA) Regression Analysis, (DT) Decision Tree, (GNB) Gaussian Naïve Bayes, (RF) Random Forest, and the impetus indemnified, vindicated, clinched results are provided by AdaBoost [28].

Our proposed system is simple, reliable, cheap, and accurate. The prototype is utilizing six sensors-based equipment EXO which is famous for its accuracy, moreover, the sensors are linked with Particle Swamp Fuzzy Analytical Hierarchical Process (PSFAHP) which is simple and accurate, and provides online results in brevity. The prototype is not adopted any other research or copied other research algorithms to this paper. This prototype is unique, fast, and meets all international criteria.

3. Proposed Methodology.

Artificial Intelligence algorithms can mitigate the disparities, morbidities in the world of aquamarine especially PSL-controlled ponds for lucrative benefits. For this purpose two main monitoring algorithms are utilized to get the indemnified, vindicated results, the first one is Fuzzy Analytical Hierarchical Process (FAHP), and the second one is Multi-criteria Decision making (MCDM). The first algorithm decides according to the weights and comparison. The following diagram depicts the FAHP functionality in pictorial form. The result is based on the weights of the following factors balanced diet or nutrient diet, conducive water temperature, pure Hydrogen (pH), presence of salinity, essential Calcium & Magnesium, etc. PSL mortality rate will be raised once the pH>10, the size of PSL is directed related to the aforementioned factors. If farmers follow they will get the results. Directions for the farmers are as follows:

Condition 1. Control condition water tank depth must be two meters, the bottom of the tank must be filled with grains and small sea stones or pebbles.

Condition 2. Oxygen pumping motors must be installed in the tanks 24x7 to supply uninterrupted oxygen supply.

Condition 3. Nutrient food must be supplied twice a day.

Condition 4. Installed water temperature sensor.

The PSFAHP distributes the analysis process in three major steps out of five steps, first, one is the discrepancy or looking received a problem for rational analysis, in part two it provides the contemplated eclectic, and third parts are incisive alternates after plethoric mathematics.

The PSFAHP method has inbuilt checks and balances.

Step 1: Pertinent Alternatives.

Step 2: Discerning analysis of provided discrepancy.

Step 3: Juxtaposition of priorities for robust contemplation.

Step 4: Meticulous Consistency.

Step 5: Get the encompassed colossal Weights as a decision.

Explanation of FAHP step by step.

Step 1: Pertinent Alternatives

The Fuzzy AHP process is checking here fourteen parameters that are closely related to PSL growth rate i-e Apparent Conditions ”AC”, Pond Milieu ”PM”, Pond thermal condition ”PTC”, dissolved salts of Calcium and Magnesium in pond ”CAM”, dissolved Hard salts ”DHS”, dissolved Soft salts ”DSS”, Nitrogen-based wastes of aquamarine creatures ”NW”, dissolved O2 ”OX”. The result is purely based on primitive factors from the environment in an assimilated way for a vindicated solution.

Step 2: Discerning analysis of provided discrepancy.

Another callous step in this regard is to dissociate a problem into pertinent smaller problems. In curtail, how deep this process will go for contemplation or where to this study will get conducive results.

Step 3: Juxtaposition of priorities for robust contemplation.

This establishes pairs of a matrix, in curtail one factor may establish a relationship evenly with other lower levels factors.

Step 4: Meticulous Consistency

This step glorifies liquidity with appreciation, in curtail it is twice as important as another factor protection from downfall (PFD) and the relationship of (PFD) with appreciation is one by two.

Step 5: Get the encompassed colossal Weights as a decision.

The FAHP mesmerizes the user by performing deep contemplation of voluminous data for irrefutable succinct results. In short, it is a scrupulous tool that surpassed other AI algorithms.

Fuzzy AHP Triangular Scale is equal to AHP scale here for better explanation FAHP=AHP

- Equally Important (E_Imp) = (1,1,1)=1
- Weakly Important (W_Imp) =(2,3,4)=3
- Fairly Important (F_Imp) =(4,5,6)=5
- Strongly Important (S_Imp) =(6,7,8)=7
- Absolute Important (A_Imp) =(9,9,9)=9

List of intermediate values

- (1,2,3)=2
- (3,4,5)=4
- (5,6,7)=6
- (7,8,9)=8

For Reciprocal conversion following relationship is used $\tilde{A}^{-1} = (\frac{1}{u}, \frac{1}{m}, \frac{1}{l})$. Furthermore rule of multiplication is as follows: $\widetilde{A_1} \bigotimes \widetilde{A_2} = (l_1, m_1, u_1) \bigotimes (l_2, m_2, u_2) =$

$$\{(l_1 * l_2),\ (m_1 * m_2),\ (u_1 * u_2)\}$$

$$\widetilde{w_i} = \widetilde{r_i} \otimes (\widetilde{r_i} \oplus \widetilde{r_2} \oplus \cdots \oplus \widetilde{r_n})^{-1}$$

Table 2: FOUR DIFFERENT PSL PONDS POTENCIES.

Fuzzy AHP	Fuzzy Geometric mean Value $\widetilde{r_i}$
Pure Hydrogen (pH)	(3.301, 3.946, 4.529)
Dissolved Calcium and Magnesium	(1.513, 2.030, 2.569)
Dissolved Hard & Soft salts	(1.157, 1.435, 1.781)
Dissolved O2	(0.617 ,0.764, 0.953)
Apparent Conditions C^0	(0.416 ,0.507, 0.660)
Nitrogen based wastes of aquamarine creatures	(0.190, 0.212, 0.240)
Fuzzy Weight : $\widetilde{w_i}$	**(7.196 , 8.896, 10.735)**

Source: Authors.

3.1. Pseudocode and Algorithm.

Algorithm PSFAHP for PSL growth

A) PSL Egg laying location.

a. Cost (C(X)) = sphere of PSL (X) eggs

//Process social space of sphere

b. No_of_variables = 3 dimensions space

//Number of decision variables

c. R → 1 , Col → No of Variables

// Matrix initialization

d.Matrix $_{SIZE}$ = [Row Col]

// Matrix of Variable_size , Matrix $_{SIZE}$ Decision variables

Table 1: FOUR DIFFERENT PSL PONDS POTENCIES.

Fuzzy AHP	Pure Hydrogen (pH)	Dissolved Calcium and Magnesium	Dissolved Hard & Soft salts	Dissolved O2	Apparent Conditions C^0	Nitrogen based wastes of aquamarine creature
Pure Hydrogen (pH)	**(1,1,1)**	**(2,3,4)**	**(3,4,5)**	**(4,5,6)**	**(6,7,8)**	**(9,9,9)**
Dissolved Calcium and Magnesium	**(1/4,1/3,1/2)**	**(1,1,1)**	**(2,3,4)**	**(4,5,6)**	**(1,2,3)**	**(6,7,8)**
Dissolved Hard & Soft salts	**(1/5,1/4,1/3)**	**(1/4,1/3,1/2)**	**(1,1,1)**	**(2,3,4)**	**(4,5,6)**	**(6,7,8)**
Dissolved O2	**(1/6,1/5,1/4)**	**(1/6,1/5,1/4)**	**(1/4,1/3,1/2)**	**(1,1,1)**	**(2,3,4)**	**(4,5,6)**
Apparent Conditions C^0	**(1/8,1/7,1/6)**	**(1/3,1/2,1/1)**	**(1/8,1/7,1/6)**	**(1/4,1/3,1/2)**	**(1,1,1)**	**(4,5,6)**
Nitrogen based wastes of aquamarine creatures	**(1/9,1/9,1/9)**	**(1/8,1/7,1/6)**	**(1/8,1/7,1/6)**	**(1/6,1/5,1/4)**	**(1/6,1/5,1/4)**	**(1,1,1)**

Source: Authors.

Table 3: FUZZY WEIGHTS OF FOUR DIFFERENT PSL PONDS.

Fuzzy AHP	Fuzzy Geometric mean Value $\tilde{r_i}$	$\widetilde{A^{-1}} = (l, m, u)^{-1}$	$\widetilde{w_i} = \widetilde{r_1} \otimes (\widetilde{r_2} \oplus \widetilde{r_3} \oplus \cdots \oplus \widetilde{r_n})^{-1}$
Pure Hydrogen (pH)	(3.301, 3.946, 4.529)	(3.301,3.946,4.529)⊗(0.0931,0.1124,0.13894)	(0.307558763,0.443652437,0.62941518)
Dissolved Calcium and Magnesium	(1.513, 2.030, 2.569)	(1.513, 2.030, 2.569) ⊗ (0.0931,0.1124,0.1389)	(0.140936716,0.22819734,0.357067515)
Dissolved Hard & Soft salts	(1.157, 1.435, 1.781)	(1.157, 1.435, 1.781) ⊗ (0.093,0.112,0.13)	(0.10777775,0.161359887,0.247576787)
Dissolved O2	(0.617 ,0.764, 0.953)	(0.617 ,0.764, 0.953) ⊗ (0.09314,0.1124,0.1389)	(0.057537173,0.08596056,0.132442836)
Apparent Conditions C^0	(0.416 ,0.507, 0.660)	(0.416 ,0.507, 0.660) ⊗ (0.09314,0.1124,0.1389)	(0.038780232,0.05700304,0.091830733)
Nitrogen based wastes of aquamarine creatures	(0.190, 0.212, 0.240)	(0.190, 0.212, 0.240) ⊗ (0.09314,0.1124,0.1389)	(0.017770778,0.023826732,0.03339956)
Fuzzy Weight :	**(7.196 , 8.896, 10.735)**	**(1/7.196 , 1/8.896,1/10.735)**	

Source: Authors.

Table 4: RESULTS BY FUZZY AHP FOR FOUR DIFFERENT PSL PONDS.

	De-Fuzzification	Center of Area	Normalized Weights
Pure Hydrogen (pH)	(0.307558763,0.443652437,0.629415187)	0.460208796	0.436617751
Dissolved Calcium &Magnesium	(0.140936716,0.22819734,0.357067515)	0.24206719	0.229658436
Dissolved Hard & Soft salts	(0.10777775,0.161359887,0.247576787)	0.172238144	0.163408939
Dissolved O2	(0.057537173,0.08596056,0.132442836)	0.09198019	0.087265137
Apparent Conditions C^0	(0.038780232,0.05700304,0.091830733)	0.062538002	0.059332203
Nitrogen based wastes of aquamarine creatures	(0.017770778,0.023826732,0.033399561)	0.024999024	0.023717534
	Sum of Weights	1.054031346	1

Source: Authors.

Table 5: AHP POTENCIES FOR FOUR DIFFERENT PSL PONDS.

Potencies	Norm 1	Norm 3	Norm 5	Norm 7	Norm 9	Norm 11
Pure Hydrogen (pH)	4.9 ~ 5.8	5.9 ~ 6.8	6.9 ~7.8	7.9 ~8.8	8.9 ~9.8	9.9 ~10.8
Dissolved Calcium and Magnesium	3.9 ~4.8	4.9 ~5.8	5.9 ~6.8	6.9 ~7.8	7.9 ~8.8	8.9 ~9.8
Dissolved Hard & Soft salts	0.0~0.90	1.0~ 1.90	2.0~ 2.90	3.0~ 3.90	4.0~ 4.90	5.0~ 5.90
Dissolved O_2	100.0~ 129.0	130.0~ 159.0	160.0~ 199.0	200.0~ 229.0	230.0~ 259.0	260.0~ 290.0
Apparent Conditions C^0	21.0~ 21.90	22.0~ 22.90	23.0~ 23.90	24.0 ~ 24.90	25.0 ~ 25.90	26.0 ~ 26.90
Nitrogen based wastes of aquamarine creatures	50.0 ~ 69.0	70.0 ~89.0	90.0 ~ 109.0	110.0 ~ 129.0	130.0 ~ 159.0	160.0 ~ 190.0

Source: Authors.

Table 6: AHP COMPUTATION TOWARDS IRREFUTABLE RESULTS.

Potencies	Pure Hydrogen (pH)	Dissolved Calcium & Magnesium	Dissolved Hard & Soft salts	Dissolved O_2	Apparent Conditions C^0	Nitrogen based wastes of aqua creatures
Norm "A"	0.273	0.24	0.15	0.38	0.29	0.2133
Norm "B"	0.235	0.21	0.35	0.26	0.21	0.2389
Norm "C"	0.221	0.22	0.25	0.269	0.31	0.2489
Norm "D"	0.271	0.33	0.25	0.091	0.19	0.2987
SUM	1	1	1	1	1	1

Source: Authors.

Table 7: RESULTS BY AHP FOR FOUR DIFFERENT PSL PONDS.

Domain	AHP provided Weights	Norms	Control condition Pond	Approval
Pure Hydrogen (pH)	**0.336**	0.216	A	Approved
Dissolved Calcium and Magnesium	0.063	0.283	B	
Dissolved Hard & Soft salts	0.328	0.258	C	
Dissolved O2	0.033	0.243	D	
Apparent Conditions C^0	0.11	0	None	
Nitrogen based wastes of aquamarine creatures	0.129	0	None	

Source: Authors.

e. $Min_{Variable}$ = 0 , $Max_{Variable}$ = 300,000
// No egg, avg(egg)

B) Essential parameters of PSFAHP
a. Iterations (I) = 7 // 7 Stages of PSL
b. Population (P)= 0.57*P // 57% survival rate only
c. Inertia (W) = 1 // Inertia coefficient
d. W_damp= 0.99 // In Inertia damping ratio
e. Learning Coefficient (C_1) or (A) = 2
// Personal Acceleration Coefficient
f. Learning Coefficient (C_2) or (A) = 2
// Global Acceleration Coefficient

C) Beginning of PSFAHP: $X_i^{t+1} = X_i^t + V_i^t * t$ // Details of Particle
a. position_null_particle[]= pnp
b. velocity_null_particle[]= vnp
c. cost_null_particle[]= cnp
d. best_position_null_particle[]= bpnp
e. best_cost_null_particle[]= bcnp
f. $V_{k+1}^i = wV_k^i + C_1 r_1 \left(xBest_i^t - X_i^t\right) + C_2 r_2 \left(gBest_i^t - X_i^t\right)$
g. particle = repeat (null_particle, P ,1)
// Formation of particle population
i. Loop i=1:P // Initialization of members population
ii. Particle(i).velocity= zeros(Varsize) //Initiation of velocity
// Random solution generation
iii. Particle(i).position = uniform_Random_number ($Min_{Variable}$, $Max_{Variable}$, Matrix $_{SIZE}$)
iv. Particle(i).cost = C(Particle(i).position)
// Evaluating cost function
v. Particle(i).NatureBest.Position = Particle(i).Position
//Calculate Nature Best Particle Position xNatureBest
vi. Particle(i).NatureBest.Cost = Particle(i).Cost
Nature_best.cost= ∞
h. Replace Particle best with global best

calculate Nature Best group Particle Position gNatureBest
i. Loop
1. Particle(i).cost < Nature_best.cost

Update personal best
2. Replace Particle(i).cost with Nature_best.cost
ii. End loop \\ End loop

D) Calculation of PSFAHP
a. Loop i= $Min_{Variable}$: $Max_{Variable}$ \\ Updated velocity
i. Loop j=1:P
ii. Particle(i).velocity= W*{ Particle(i).velocity} + (C_1)*rand($Matrix_{SIZE}$).*(best_position_null_particle(i) - Particle(i).position) + (C_1)*rand(Matrix $_{SIZE}$).* (Particle(i).NatureBest.position- Particle(i).position)
iii. Particle(i).position = Particle(i).position+ Particle(i).velocity \\ Updated position
iv. Particle(i).cost = C(Particle(i).position) \\ Evaluation
v. Particle(i).NatureBest.position = Particle(i).position
vi. Particle (i). NatureBest.cost = Particle(i).cost

E) For Decision Making
i. Load FAHP, input {pH, Dissolved Ca++, Mg++, O2, Soft & Hard salts, Aquamarine waste, apparent conditions}
ii. Load Related & sub related criteria's
iii. Load Pairwise related & sub related criteria's
1.Conversion of Single digit number into triangular number
2. Low 'l'> Medium 'm' >Upper 'u'
3. Transform FAHP into Fuzzy Geometric Mean "$\widetilde{r_i}$
4. Transform → $\widetilde{W_1} = \widetilde{r_i} \otimes (\widetilde{r_2} \oplus \widetilde{r_3} \oplus \ldots \oplus \widetilde{r_n})^{-1}$
5. Process → a) Fuzzy Weights
b) De-Fuzzification c) Center of Area
6. Result → Normalized Weights
7. Results Question: How many PSL survived in each quarter out of seven quarter?

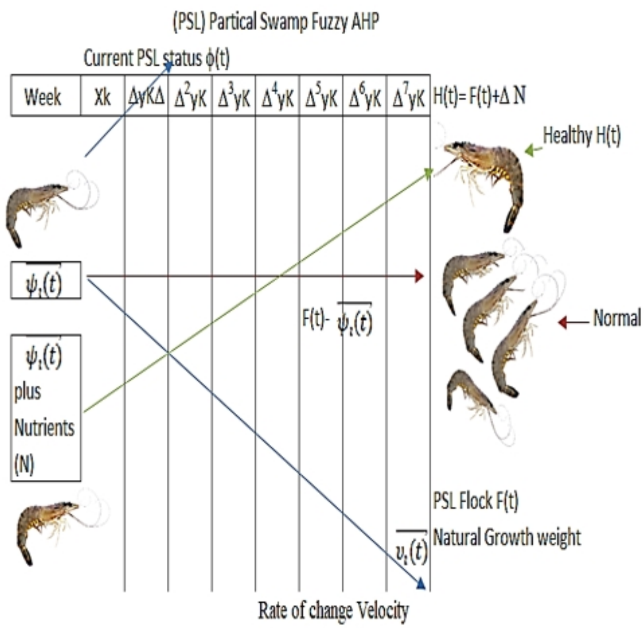
F) Outcome
a. Updated Particle best position
b. Updated Particle best cost
c. Best pond for PSL survival[30]

4. Result and Discussion.

This research has made use of Optimization of a particle swamp. By maintaining a constant velocity in dimension D, the PSL communicates with another particle and learns how to achieve the goal. The PSFAHP begins by calculating the population and cost C. (X). The results are based on the formula H (t) = F (t) +ΔN, which indicates that PSL fitness is based on nutrients in three-dimensional space (3D). Part B initializes the parameters for the first iteration, with a population of 57 percent inertia, W damp of 0.99, and two learning coefficients C_1 and C_2. Particle properties such as position, velocity, cost, optimum position, and best cost position are addressed further. The relationship indicates particle velocity as well as the best cost of nature through this equation $V_{k+1}^i = wV_k^i + C_1 r_1 \left(xBest_i^t - X_i^t\right) + C_2 r_2 \left(gBest_i^t - X_i^t\right)$. In 3D space, position and velocity are updated later. Finally, through FAHP, this research will determine which pond is the best and where they moved from their original position to their final location. The following points form the basis of the criteria: pH, dissolved Ca++, Mg++, O_2, soft and hard salts, aquamarine waste, and apparent conditions all of the preceding is explained in Figure 4. The sensor EXO_2 is being used in this study. So far, this sensor has produced the data that has allowed pond "B" to adopt the proper pH, chemical, nutrient, and temperature levels. Other ponds, on the other hand, are not performing as expected, thus the system has rejected them and notified the farmers. Table 1 shows how Fuzzy AHP is used to meet the specified requirements. Farmers must add nitrogen-based aquamarine waste to the pond, then maintain temperature, pH, and other factors for optimal PSL growth, according to this table. The Fuzzy Geometric Mean Value $\widetilde{r_i}$ is afterwards determined using the following formula $\widetilde{w_i} = \widetilde{r_i} \otimes (\widetilde{r_i} \oplus \widetilde{r_2} \oplus \ldots \oplus \widetilde{r_n}$. Similarly, Fuzzy weight was determined using the following formula $\widetilde{w_i}$ =

$\widetilde{r_1} \otimes (\widetilde{r_2} \oplus \widetilde{r_3} \oplus \cdots \oplus \widetilde{r_n})^{-1}$. After De-Fuzzification and the center of the area of the normalized weight, this study concluded that a healthy pond must have an acceptable pH, dissolved calcium and magnesium, soft and hard salts, and finally, the center of the area of the normalized weight. In contrast, AHP accuracy is low when compared to Fuzzy AHP, but it forecasted the same in tables 5 to 7, and pH score was 0.336, and so on.

Figure 2: Particle Swamp FAHP for PSL growth.



Source: Authors.

Conclusion and Future Work.

The nature of prawn, shrimp, and lobster (PSL) is identified in this applied research study. Particle Swamp Optimization demonstrates the migration of PSL from an ordinary position to the ideal spot in order to achieve the best nutrition food. As a result, PSL were separated into different ponds. These ponds provided them with various domain inputs. The most acceptable combination is followed by Pond ’B’. As a result, the PSL survival rate is consistent and high when compared to other ponds. Various sensors will be employed in the near future to achieve the best results. The PSL death rate must be predicted in black and white.

Data Availability.

Initial curative PSL data is collected by the PSL farmers.

Conflict of Interest.

There is no conflict of interest because this research is solely for the benefit of farmers.

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