

## International Journal of Innovative Research in Science, Engineering and Technology

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# A Survey on Temperature & Humidity Control by Using Neural Network for Oyster Mushroom Cultivation

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**ABSTRACT:** For oyster mushroom growth the environment parameters should be favorable. These environmental parameters are temperature and humidity which are very important parameter for the production of oyster mushroom. Controlling these environment parameters is very delicate task as cultivation space remains stable at temperature range between 22-28<sup>0</sup> C and humidity 60-90%. So for accurate measurement of humidity and temperature, we are showcasing a survey in which the values of the humidity and temperature are given to the arduino and serial communication. Furthermore ANN(Artificial Neural Network) is used for the decision making of DC Fan and Mist Maker. These device mainly used to maintain temperature and humidity. We are explaining the algorithm of Neural Network used in our system. We have also compared feed forward neural network. The aim of this system is automatically control the temperature and humidity in mushroom cultivation plant.

**KEYWORDS:** Cultivation of Oyster Mushroom, Feed Forward Neural Network, DHT11, Matlab.

### I. INTRODUCTION

Oyster mushroom (*Pleurotus* sp.) belonging to Class Basidiomycetes and Family Agaricaceae is popularly known as 'dhingri' in India and grows naturally in the temperate and tropical forests on dead and decaying wooden logs or sometimes on dying trunks of deciduous or coniferous woods. It may also grow on decaying organic matter. The fruit bodies of this mushroom are distinctly shell or spatula shaped with different shades of white, cream, grey, yellow, pink or light brown depending upon the species.

The mushroom, which was once a wild plant, has now become a high source of nutrients for humans. Oyster mushroom is one of the mushroom which is high in demand by the public. Nowadays the growth of oyster mushroom needs is increased. But in reality, the productivity of mushroom cultivation is still considered suboptimal. This is due to the cultivation of mushrooms require ideal temperature and humidity (temperature 22 - 28 ° C with a humidity of 60% - 80%) in order to obtain optimal results. While for now the process of controlling the temperature and humidity to reach the ideal mushroom cultivation is done by conventional manner using a manual sprayer and make it more difficult for farmers to obtain the optimal results and when at the dry season it takes extra energy to secure the conditions of temperature and humidity of mushrooms house. Based on this background, the manufacture of automated tools to control temperature and humidity oyster mushroom farm house is proposed. Using two data processing methods to find the most optimal and effective method in order to get maximum performance result, it's controlled by microcontroller Arduino Mega. This tool is created to give solution for increasing the productivity of oyster mushroom cultivation in order to remain optimal throughout the year, not limited to season, and also the location of cultivation can be carried out in low-lying areas and upland areas.

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## II. LITERATURE REVIEW

In tropical countries like India with relatively low to high levels of temperature, mushroom can't grow easily. Farmers commonly cultivate mushroom in plants house in order to obtain the appropriate environmental conditions for growth. Although most of the oyster mushroom can grow well at a temperature range of 25-30°C with humidity above 80% but the optimum growth conditions achieved at a temperature range of 16-22°C. Research related for comparing two methods Fuzzy Logic Control and Feed Forward Neural Network has been done to get desired humidity (60% - 80%) & temperature (22 -28 ° C) using two data processing methods i.e. fuzzy logic control and feed forward back-propagation neural network. These two methods will be compared to determine the most optimal and effective method when it applied to the tool to automatically control temperature and humidity oyster mushroom farm house [1].

In addition, Theeramet Kaewwiset and Paitoon Yodkhad also conducted research to build an application of fuzzy logic to determine appropriate temperature and humidity for Straw mushroom (24 -28 ° C & 70 -80%). This researcher designs to experiment for 3 types of mushrooms are Straw mushroom, Angel mushroom, and Oyster mushroom in mushroom nursery size 3×5×3.5 meters. The results of this experiment are to control appropriate temperature and humidity for 3 types of mushroom that used in the experiment. This paper present about controlling temperature and humidity values for mushroom nursery by using Fuzzy Logic. Researcher develops Fuzzy Logic learning machine from expert experiences. This system is use for increasing efficiency of mushroom growth by adjusting temperature and humidity and saving human resources and man power for monitoring in mushroom nursery [2].

Another research in application of Fuzzy Logic to Predict the Size Quality of White Oyster Mushroom with Temperature, Light Intensity and Humidity Inputs. In this research, temperature control with conventional process or manually will be less effective because of the oyster mushroom cultivation need more attention of the temperature and humidity in the cultivation space remains stable at temperatures range between 16-28 degrees Celsius, humidity 60-90 percent, and the intensity light dark minimal 500-1000 lux to produce mushrooms with a maximum size. The oyster mushroom is a high-protein food that can live in upland areas with certain temperature and humidity. Currently oyster mushrooms become one of profit business opportunity, because the nutrients and many benefits that contained in this mushrooms. Besides the sale value of the oyster mushroom is also high. It is encouraging farmers in lowland areas to cultivate oyster mushrooms. The results from this study is an application to help predict the range of temperature (21°C), humidity (90%) and light intensity (800 lux) for getting optimum condition for increase the white oyster mushroom production with maximum size (7.5 cm) [3].

In Back-propagation Neural Network (BPNN) method also has applied to many kind of identification systems, but the BP-NN usually has problem with training process. So that, many methods were developed to improve it, such as CBP-NN. CBP-NN also has been successful applied to solve many engineering problems [4]. The smart-meter was developing, not only talk about the concept, but also implement standalone smart meter in the real system. This is also one of reason using transient peak value and steady state value which is adapting from as a method. The method is easier to implement in ARDUINO-UNO as a Microprocessor in this research. Combining with constructive back propagation neural network (CBP-NN) can reduce the size of NN structure.

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## III. METHODOLOGY

### A. Design System

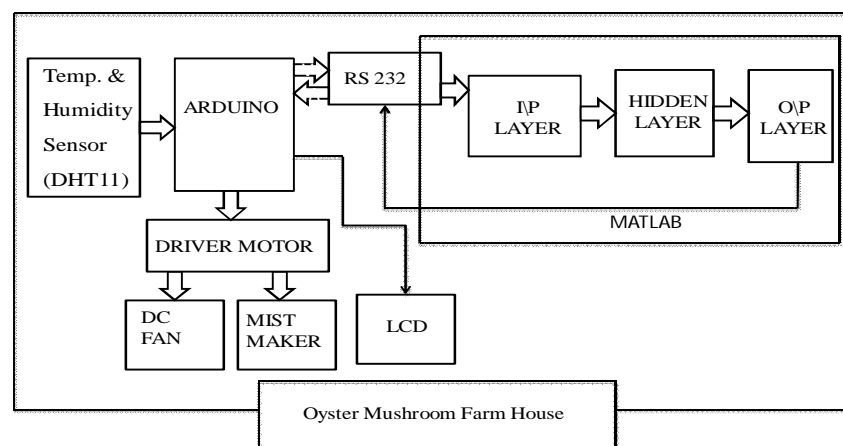


Fig.1. Overall System Block Diagram

The above fig.1 shows the block diagram for Automatic Operating Temperature and Humidity Control System (Oyster Mushroom Farm House) Using Microcontroller and Feed Forward Neural Network.

As shown in fig.1, we design the system which is useful for the oyster mushroom house. The Arduino is the main controller used here. The DHT11 sensor is used to measure temperature and humidity of mushroom house. While output in this system there are two actuators, the exhaust DC fan and mist maker. At initial stage temperature and humidity of oyster mushroom house is measured and it is given to Arduino connected to it then the NN method applied on the temperature and humidity control device i.e. exhaust fan and mist maker connected to Arduino using two DC motor. Validating method of data processing is done by using MATLAB. MATLAB is used as a calibrator if a micro's program error occurs.

System tools work automatically to control temperature and humidity of Oyster Mushroom Farm House, by controlling environmental conditions such as temperature and humidity to optimize the growth of oyster mushrooms. Changes in temperature and humidity of oyster mushrooms house detected by the DHT11 sensor. DHT11 sensor data will be used as inputs to be processed by the brain of the system, using the Arduino Mega with Feed Forward Neural Network calculation to serve as a reference value in taking action in carrying actuators (Exhaust Fan and Mist Maker). Data temperature and humidity mushrooms house will be displayed on the LCD in real time. For more details can be seen in the overall system flowchart in Fig. 2.

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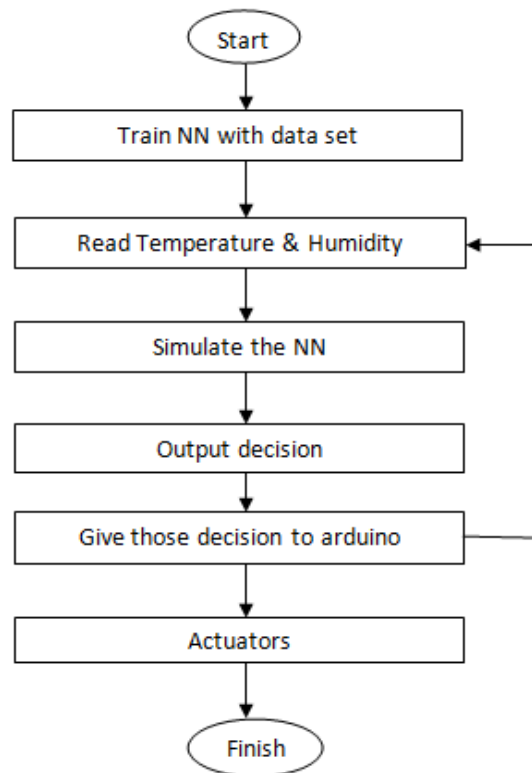


Fig.2. Flow chart of the system

## B. Algorithm and Training Method

Feed forward Back-propagation:

- In training neural network, it need to use both algorithms i.e. feed forward algorithm and back propagation algorithm.
- Back-propagation training algorithm consist of 2 steps:
  1. 'Feed forward' the values
  2. Calculate the error and propagate it back to the earlier layers. So to be precise forward- propagation is part of the back propagation algorithm but comes before back-propagating.
- It is an algorithm to train (adjust weight) neural network.

Primary data used for training section are 25 data's (Temperature range from 20-40 °C and Humidity range from 20-90%). The training process is started by using MATLAB software to get the best model based on the training data. Different values of temperature and humidity has been set with different condition using MATLAB programming. On the basis of these values we can control the temperature and humidity of oyster mushroom house using exhaust fan and mist maker connected to arduino through relay.

Fig.3 shows NN train tool which monitor training progress and calculate statistical results and training quality.

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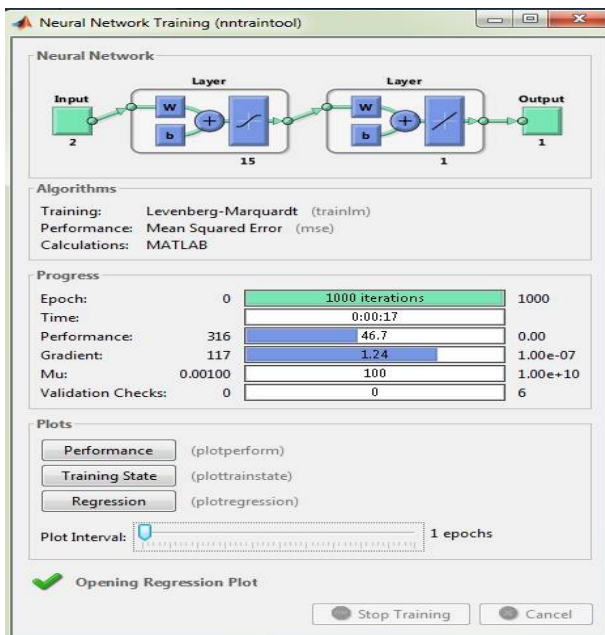


Fig.3. NN Train tool

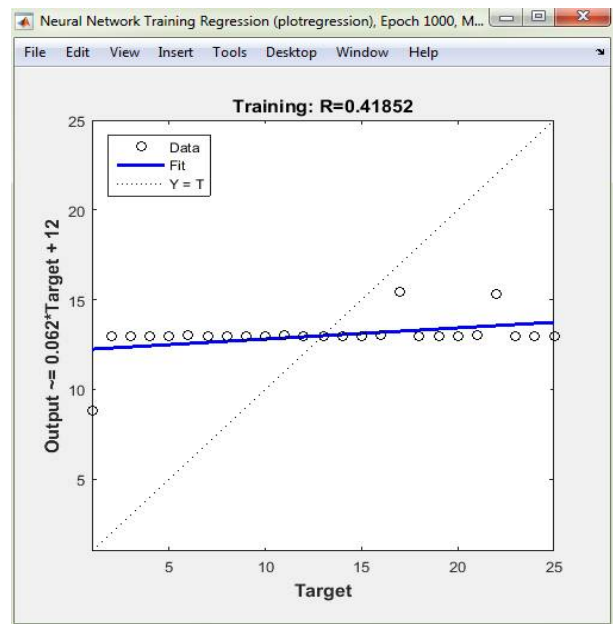


Fig.4. Regression

In above fig.3, we can see Input, Layers and Output. Input will be the data sets provided to the system. Output will get after processing these data sets. In Layer, W represents weight matrix and b represent a vector matrix. These matrices are processed and provided to transfer functions. We have used trainlm function to train NN tool. trainlm is a network training function that updates weight and bias values according to Levenberg-Marquardt optimization. Performance can be acquired from Mean Squared Error graph. From fig.4, this graph infers the best fit output for the system with respect to Target data.

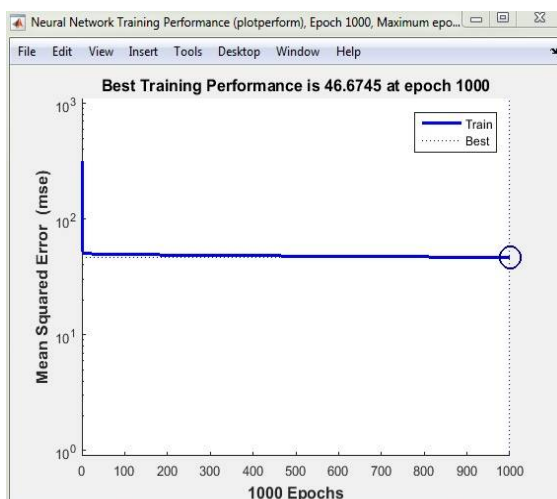


Fig.5. Training performance

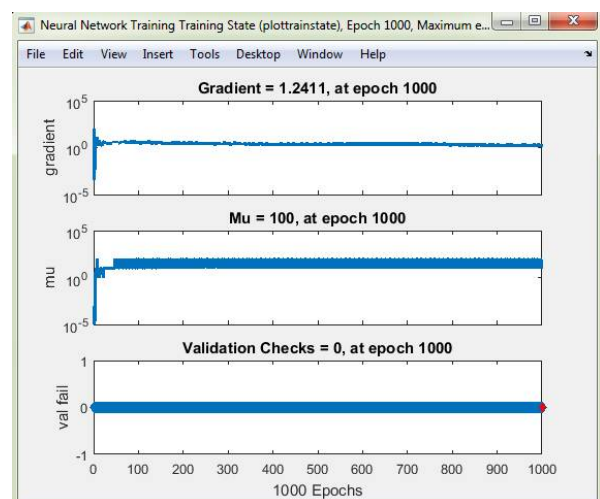


Fig.6. Training State

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From the fig.5, it infers that the system actually took 1000 epochs to get to the best performance and acquired Best Training Performance is 46.6745 for this instance. An Epoch is an event or a time marked by an event that begins a new period or development Maximum number of epochs to train the tool is 1000. Mu stands for Momentum update. Mu is the control parameter for the algorithm used to train the neural network. In fig.6, at epoch 1000, we observed training state as Gradient was 1.2411, Mu was 100 and there weren't any validations failures occurred.

## IV. CONCLUSION

In our proposed system the survey of feed forward neural network used to control environmental parameters which are temperature and humidity required for growth of oyster mushroom. MATLAB programming is used for implementation of feed forward neural network. Different values of temperature and humidity (ranges from 20-40<sup>0</sup>C and 20-90%) has been set with different condition using MATLAB programming. On the basis of these values we can control the temperature and humidity of oyster mushroom house using exhaust fan and mist maker connected to arduino through relay. Implementation of feed forward neural network is used for setting different values of temperature and humidity with different condition.

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