

Monitoring of Environmental parameters in Smart Greenhouse using Wireless Sensor Network and Artificial Neural Network

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ABSTRACT

Environmental monitoring is a type of monitoring in which, monitor the quality of environment and we are measure the Environmental physical parameter and control the all environmental physical parameter according to environment required. All types of Environmental program are design and start according to current situation of Environmental physical parameter. India is very largest country in this world and many people depends on agriculture because India world 2nd largest agriculture activity done [1], but there are many problems are interrupt. Water is main issue for agriculture because weather is not supportive and all farmers are depends on natural water and rain water and it is not easily available due to global warming. In recent years, we are use 85% fossil fuel for energy resource and all country are depends on gas, oil, coal, wood. Due to uses of oil, gas and coal they cause many harmful effect on our health or environment and these effects are acid rain, ozone, global warming and smog [2]. Here we have discuss about the some scientific reason for air pollution due to greenhouse gases, thermal pollution and combustion of fossil fuel and its effect on our environment or human health.

Keywords :- WSN, Greenhouse, ANN, MATLAB, Greenhouse gases

1. INTRODUCTION

Wireless sensor network technology very most important technology in agriculture because with the help of wireless sensor network technology we can save more water for agriculture and wireless sensor network is very useful for water saving in irrigation [3].

In wireless sensor network, there are many sensor are used in agriculture and environment for different parameter like air pressure, water level, gases level, soil moisture, climate change humidity of air, sunlight, temperature and some other parameters [4]. These all parameter are very important for agriculture because all farmers are dependent on weather conditions and rain water, so it is very helpful. Wireless sensor network in agriculture all farmers are using mobile phones in executing their farming conditions and business at the same time [5].

2. PROPOSED MODEL

In this project model, it can be described in different parts. The microcontroller module set will connect with power supply, connection checked up and procedure is preceded. All sensor nodes are designed as per circuit diagram and connections are built with respect to circuit diagram. The parameter controls are individually and these parameters which can be implemented in a green house are Temperature control, Soil control, Humidity control, Water level control & Light Control. The model goes with temperature control, humidity control, water level control, light control and soil moisture control measures in combination with Global System for Mobile communication modelling within the model [6].

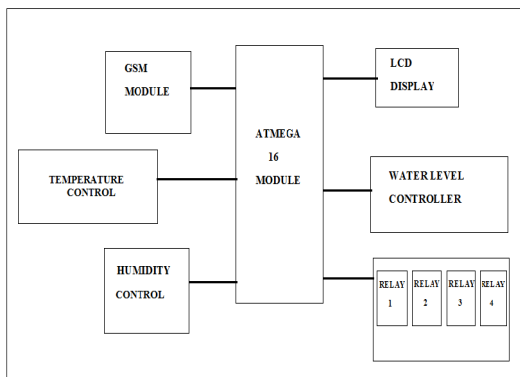


Figure 1: Block diagram of proposed model

In this model, there are five sensor nodes that are control five different parameters and these five parametric sensors are built on the PCB and measured values are displayed on liquid crystal display (LCD) one after another. The different parameters such as temperature, humidity, light, soil moisture, and water level are measured one after another and displayed on LCD.

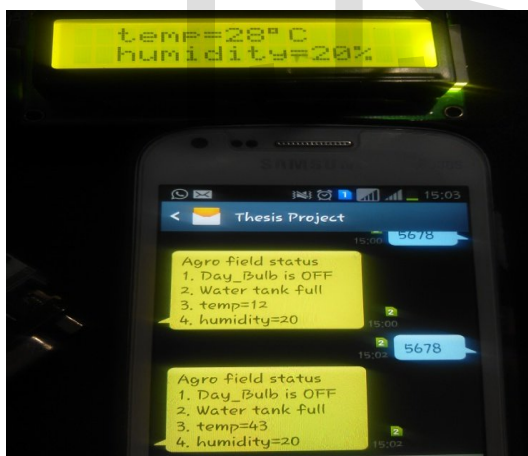


Figure 2: Results of Our Proposed Model

3. THE EFFECTS OF GREENHOUSE

When glasses are allow the sun light or solar radiation entered into a car or house and blocks the all infrared radiation emitted by interior surface, due to this process temperature of interior is very high in greenhouse, home and car. This type of heating effect is called greenhouse effect [2].

3.1 The contribution of Gases in Green house effects on the Earth.

- carbon dioxide, 9–26%
- water vapour, 36–70%
- ozone, 3–7%
- methane, 4–9%

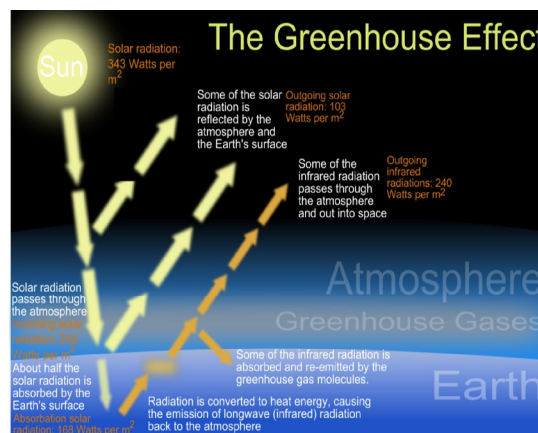


Figure 3: The Effects of Greenhouse

3.2 Effects of Greenhouse gases on our health and environment.

Carbon dioxide – Carbon dioxide (CO₂) gas is available in more amount on the earth atmosphere and it is totally waste, because it is very harmful gas for all. Carbon dioxide gas dissolves with ocean water and produce carbonic acid.

Carbon monoxide- The main source of carbon monoxide is motor vehicles in cities. In our environment, 90% of (CO) carbon monoxide are comes from motor fuels due to incomplete combustion of carbon. Carbon monoxide (CO) is decreases the level of oxygen gas in human body and effect the brain and muscles, due to this problem our body react very slow and react like a patient.

Hydrocarbon and Nitrogen oxides gas

The main source of nitrogen oxide are fossil fuels and the main source of hydrocarbon are refining the petroleum and transfer the petroleum.

When fuels are not combustion very well then it convert into hydrocarbon. Its effect on Ozone level and damage it. It is also effect on eye, plant, fruit and asthma. It is very harmful gas for human people, because it causes cancer disease, heart disease and breathing diseases [2].

Ozone layer - Ozone are effects on environment and damage the human body like (skin problem, cancer, eye problem, damage the lungs, wheezing, breath shortness, headaches, fatigue, Asthma) its cause many type of diseases. Carbon monoxide (CO) is also a serious problem in smog pollutant, because carbon monoxide (CO) is very poisonous gas, colourless gas and order less gas [2].

4. IMPLEMENTATION OF ANN

The cause of green house gases, its make environment heat and warm because, about last 100 year high level of green house gases are increase in environment atmosphere and create more heat, from 1970 to 2005 the green house gases increases by 70% and these data is measured by International Governmental Panel on Climate Change (IPCC) [7].

Here we are use The Artificial neural networks using MATLAB for monitoring the environment and Greenhouse gases [8]. We take a metrological data from Agricultural department and simulate the data by using Artificial Neural Networks. The Artificial Neural Networks (ANNs) is a family of the statistical learning models which is inspired by some biological neural networks with central nervous systems of human and animals in particular the brain.

4.1 Some Metrological data from agriculture department

Temperature level	Humidity level	Soil moisture level	Water level
26.6	16.8	21.2	13.4
29.4	18.1	22.5	16.1
32.4	19.5	25.3	18.7
32.9	25.3	26.2	22.2
31.6	25.9	25.8	26.1
29.1	27.5	27.3	25.8
30.6	26.9	26.1	23.2
31.2	28.4	27.8	24.8

5. RESULT AND ANALYSIS

We take a metrological data from Agricultural department and simulate the data by using Artificial neural networks The training is done to provide the accuracy level of 96.21% and the observer error in the dataset is of 3.79%. The target or overall error probability is estimated which is resulted in the form of linguistic variables in the software project according data sheet.

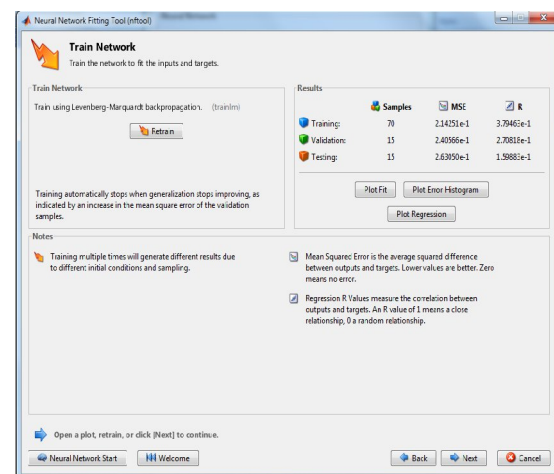


Figure 4: Training in Neural Network showing the Errors in Training, Validation and Testing

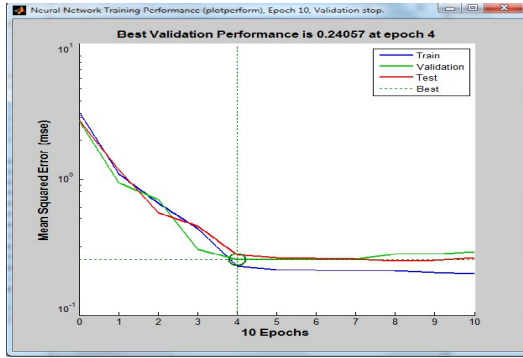


Figure 5: Performance plot after Training of Neural Network

In this graph, the training stopped when the validation error increased for six iterations, which occurred at iteration 10. In this, the result is reasonable because of the following considerations.

- The final mean-square error is small.
- The test set error and the validation set error have similar characteristics.
- No significant over fitting has occurred by iteration 10 (where the best validation performance occurs).

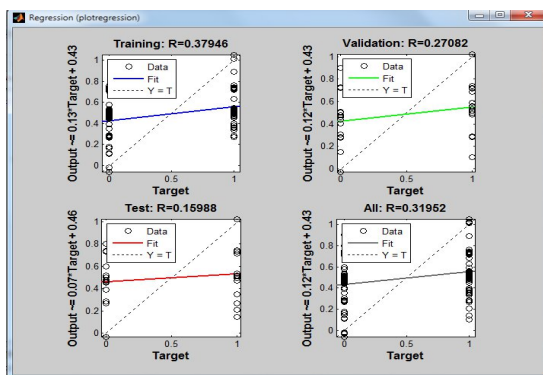


Figure 6:- Regression graph after Training of Neural Network

In this graph, the following regression plots are display the network outputs with respect to targets for training, validation, and test sets. For a perfect fit, the data should fall along a 45 degree line,

where the network outputs are equal to the targets. For this problem, the fit is reasonably good for all data sets, with R values in each case of 0.15 or above.

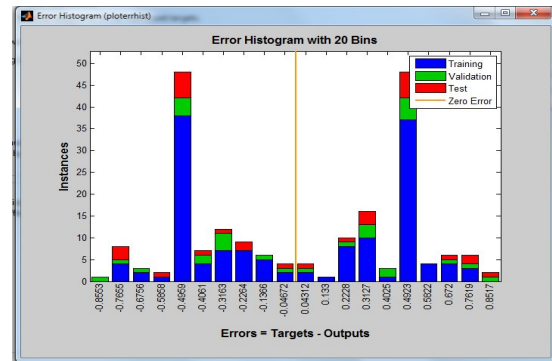


Figure 7: Error Histogram after Training of Neural Network

In the graph of Error Histogram, the blue bars represent training data, the green bars represent validation data, and the red bars represent testing data. The histogram can give you an indication of outliers, which are data points where the fit is significantly worse than the majority of data. In this case, you can see that while most errors fall between -5 and 5.

6. CONCLUSION AND FUTURE SCOPE

This one accurately reproduces the behaviour of the environment in a dynamic environment by taking into account nonlinearity of its response, the dependence in temperature, moisture, water level and relative humidity in the measure point in addition to the dependence in gas nature. The proposed ANN model was implemented as a component on SPICE simulator library, and this model was tested and validated. In the future, we will develop a multi-hop network to cover the entire Greenhouse and we will also attach the probes to the nodes so that the wireless nodes can be used to measure some other parameters from plants or flower pots. We are also considering the option to implement the some Gas sensor.

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