



# Smart Irrigation System Using CNN And DNN Survey With Crops

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**Abstract:** - due to the increase in population in India, Agriculture is considered an important source. Water is important for agriculture. To irrigate the fields, water the fields, water has to be used. Water is the life of all living beings. If crops are irrigated, plants will emerge and grains will grow. Today we are going to irrigate water through smart irrigation system. And to control the water, relay is used to switch on and off. Water is exacted from the ground by a motor pump connected to the relay. And it also helps in drawing water from wells, rivers, ponds tanks etc. A water controller is installed to pour water in equal quantity. Soil moisture is applied to check the moisture of soil. If the soil becomes wet, the crops will be irrigated and the crops will start growing. To design a hardware program, programming has to be done in software. When you run the machine, the system output will be displayed and will also be displayed in the display computer software. In this you can see amount of irrigation. With the help of cloud, farmers can know the weather. Crop health can be detected in the data. By collecting various sensor data, precision farming methods become accessible and effective.

**Keywords:**-Node MCU, soil moisture, CNN and DNN, farming, DHT11 humidity sensor, relay, Motor pump, Power Supply, Water Level, Ph Sensor, Temperature Sensor

**1. Introduction:-**Now Days, Agriculture has become very important not only in India but all over the world. It is Very Necessary for agriculture. Rivers, Ponds, Tanks etc. Are used for Irrigation. To control the water, the motor pump is switched on and off with the help of relay. The motor is used to use water from holes, wells, and underground. Soil moisture is applied check the moisture of soil in the fields. If there is moisture in the soil fields then the crops will be irrigated. So the plant emerges. With Water Smart Irrigation System, Irrigation fields can be tracked. Today we are doing agriculture with CNN and DNN. And can control water. Connect relay to motor pump, soil moisture, DHT11 Humidity, LCD display using cloud storage from Microcontroller. It is using in Node MCU with CNN and DNN; python farmers can know the weather through cloud storage. And can detect crop and soil moisture in the fields. We can do

agriculture with smart Irrigation System. There are three types of Agriculture. Monsoon Crops is grown June to November, Winter Crops is grown December to May, Zaida Crops is grown December to March, etc can be irrigate with water smart irrigation system.

Silt and clay which have smaller particles have a larger surface area and allow soil to hold more water. Sand which has larger particles with a small surface area will hold only less water. The available water capacity by soil texture.

Available Capability by Soil Texture	
Textural Class	Available Water Capacity (inches/ foot of Depths)
Coarse Sand	0.25-0.75
Fine Sand	0.75-1.00
Loamy Sand	1.10-1.20
Sandy Ioam	1.25-1.40
Fine Sandy Ioam	1.50-2.00
Silt Ioam	2.00-2.25
Silty Clay Ioam	1.80-2.00
Silty Clay	1.50-1.70
Clay	1.20-1.50

Table 1:-Water capacity by Soil Text

The complex structural chemical and physical properties involved in the soil texture and the process of prediction are more complex. It is a challenging research topic. The solar reflectance spectra of objects which are obtained from short wave solar radiation, reflects the solid phase of the soil which is covered by organic substance and crystals. These physicochemical properties, with the incident radiation and the reflected radiation is observed by a sensor, are measured to be the chief influences on the reflectance of a soil model and are used for the soil prediction type. It is measured using hyper spectral sensors which relate to particular absorption features of organic and mineral content. A much effort on pre-processing is required when mapping the reflectance spectra data to the soil texture.

### 1.1. Problem Identifications

The Smart irrigation System uses computer system and sensors to help manage various activities on the farm. Such as Soil Moisture, Water Level DHT11, and Moisture content. The water level is rising due to weather conditions. In order not to divert the attention of the farmers, water level Management done by the area should be mad more comfortable with the help of computer display. Farming should be easy. Farming seems more of a noun. Smart Irrigation System requires minimum resource to be used from hardware and the cost is much higher than threat required for manual operation. To Monitor and maintain agricultural farms using both automated and manual methods. To measure this there will be increase or decrease in the level of water and soil moisture. Smart Irrigation system uses weather data soil moisture data to determine irrigation the irrigation need of the landscape. Smart irrigation technology includes: - These products maximize irrigation efficiency by reducing water waste. While maintain plant health and

quality. Water Controllers is Automatic water level controllers are a product that was created to automatically control a motor, which helps to ensure a constant reserve of water in a storage tank. These automatic water level controllers are used to automatically fill the over-head tank when it starts or has become empty as well as monitor the water level in it. To control the water, a motor pump has been installed with the help of relay.

**1.2 Objective:-** Though CNN and DNN are sub-areas of artificial intelligence, it is necessary to apply to agriculture to various stages of farming, like crop recommendation, disease detection, yield prediction, etc.,. DNN techniques are better performance than CNN techniques. Detailed comparison analysis of CNN and DNN is mentioned in further sections.

## 2. Literature Review:-

Archana and Priya (2016) proposed a paper in which the humidity and soil moisture sensors are placed in the root zone of the plant. Based on the sensed values the microcontroller is used to control the supply of water to the field. This system doesn't intimate the farmer about the field status.

Sonali D.Gainwar and Dinesh V. Rojatkar (2015) proposed a paper in which soil parameters such as pH, humidity, moisture and temperature are measured for getting high yield from soil. This system is fully automated which turns the motor pump ON/OFF as per the level of moisture in the soil. The current field status is not intimated to the farmer.

In most of the environmental processes, soil consistency is treated as one of the significant factors. There are three one dimensional (1D) Convolution Neural Network (CNN), LucasCNN, and LucasResNet are proposed that consists of residual network for identification. Here the LucasCoordConv used as an extra layer for pre-processing. The CNN approach with the least depth is considered as the greatest performing classifier. The LucasCoordConv achieved the first-rate performance in terms of normal accuracy.

Soil consistency is a parameter that influences the selection of crop and normalizes the water flow. The images of the soil are managed through the various phases, initially for the purpose of image enrichment, pre- processing step involved, mining the section of interest for separation and the feature vector is used for quality investigation. Actually the feature vector are derived from the following elements such as Hue, Saturation, and Value (HSV) histogram, Gabor wavelets, color auto Correlogram, color moments and discrete wavelet transform. Lastly, SVM classifier is taken to categorize the images of soil using linear kernel.

One of the deep learning algorithms Convolution Neural Network (CNN) is proposed as a novel technique to foresee the features of soil from raw soil spectra. To completely employ the volume of CNN model, the soil spectral data is demonstrated as a 2D spectrogram, presenting the reflectance factor as a function of wavelength and frequency. By using varied network architecture, they predicted various soil features in a certain network and trained the process using CNN. The convolution and max pooling layers learns the structure of the spectrogram and its general representation is directed to six branches to predict six

different types of soil property. With the help of an enhanced CNN structure the model can learn the features effectively by avoiding separate pre-processing.

Topsoil information captured with a smart phone camera is used as input to predict the structure and texture of the soil in. The Low-level image features such as color and other texture are extracted and mapped with reolocation information with the existing land information. A NN model is used for predicting the soil texture of three types - sand, silt and clay. The prediction is also made on the soil structure with the five-point scale and other soil features such as soil density, pH value and drainage categorization of particular soil. Better spatial resolution of the soil mapping is needed in their work to further improve the performance.

Archana and Priya (2016) published a paper in which determined value of soil and a temperature sensor placed in roots of plants control the switch on and switch OFF of the water motor. The drawback of their project is that they didn't include any technique to send the status of the agriculture field to the user.

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V. R. Balaji and M. Sudha (2016) proposed a paper in which the system derives power from sunlight though photo-voltaic cells .This system doesn't depend on electricity. The soil moisture sensor has been used and based on the sensed values PIC microcontroller is used to ON/OFF the motor pump. Weather forecasting is not included in this system.

R.Subalakshmi (2016) proposed a paper to make irrigation system simpler, the complexities involved in irrigation is tackled with automation system using microcontroller and GSM. Based on the sensed values from soil moisture, temperature and humidity sensors, the GSM sends message to the farmer when these parameters exceed the threshold value set in the program. The nutrient content in the soil is not determined by this system.

Karan kansara (2015) proposed an automated irrigation system where the humidity and temperature sensors are used to sense the soil conditions and based on that microcontroller will control the water flow. Farmer will be intimated through GSM. This system doesn't monitor the nutrient content in the soil.

Prof C.H.Chavan and P.V.Karnade (2014) proposed a smart wireless sensor network for monitoring environmental parameters using Zigbee. These nodes send data wirelessly to a central server, which collects data, stores it and allows it to be analyzed then displayed as needed and also be sent to the client mobile. Weather forecasting and nutrient content is not determined in this system.

### 3. Methodology

#### 3.1 Block Diagram:-

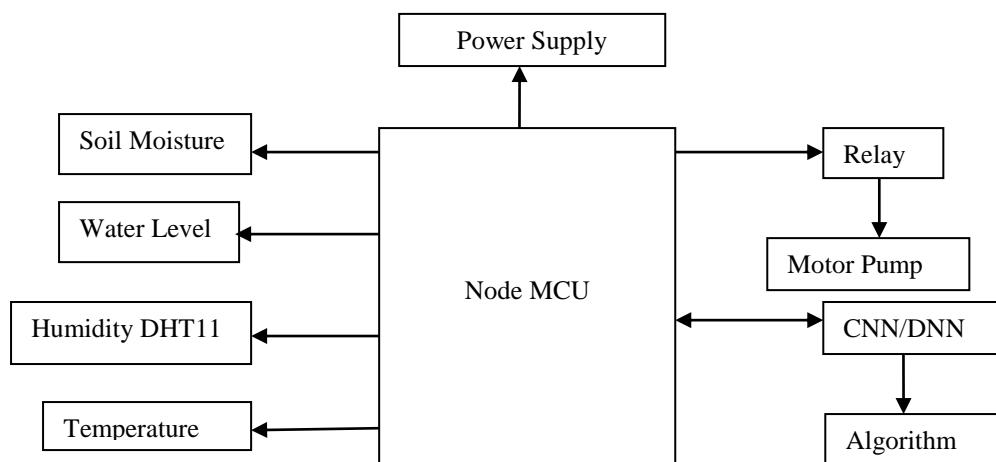


Fig:-Smart irrigation System Block Diagram

#### 3.2 Working: -

In Smart Irrigation System, Soil Moisture, DHT11 Humidity, Temperature, PH, Water Level etc. CNN and DNN with IOT have been connected to Node MCU. To control water and for irrigation, six sensors such as water level, soil moisture, Temperature, DHT11 Humidity, PH sensor etc is used. Motor pump has been installed to irrigate the field and Computer System Software display has been installed to detect the irrigation water. And the quantity of water can be seen from the Computer Display. If there is moisture in the soil in the fields than the crop will be goods. The harvest will good. Then you will get grains. The amount of water in fields should be equal. The more water. Or there will be crop lass and disease may also occur. Therefore, water controller has been used to increase or decrease the water. Relay is used to switch on off the water motor pump. Today we can do irrigation through smart irrigation system. To run the program the device has to be connected. When the hardware runs. The output appears in the display of the software. The health of plants and crops, soil moisture is detected. And the output is easily detected in the sever. In Smart irrigation System, the power supply is a source of energy such as Voltage, Current, and Frequency, with help of motor pump connected to relay, irrigation and watering water in field can be controlled. The current voltage frequency of the motor is measured with smart irrigation system. The power supply goes to the entire fields.

CNN and DNN used to Micro irrigation is an advantaged irrigation System by which water is supplied to the root zone of plants at short intervals through specially made plastic pipes. Micro irrigation system consist such as micro/injector, Distribution lines and equipment, control head system, fertilizer tank paraphernalia

## Advantage and Disadvantage of micro irrigation:-

1. This system saves 40-60 percentage irrigation water.
2. The quality of Product high.
3. There is reduction in labour expenses.
4. The possibility of salt accumulation in the root zone is reduced.
5. The incidence of diseases reduces.
6. Soluble chemicals and fertilizers can be easily used with irrigation water.

If fertilizer is given by adopting this system, it saves a lot. Along with the advantages of this system, there is also some disadvantages like-in the initial stage. There is more investment in pipelines and necessary systems. Sometimes due to some reason the pores get clogged. Apart from these, sometimes pipes and parts are stolen.

## 4. CNN and DNN Architecture and Sensor:-

**1. CNN:-** A distinct category of NN which behaves very fine by data that is spatially associated is Convolution Neural Networks (CNN). CNN can routinely acquire attributes with spatial relationships. Location-based relation with other information is termed as Spatial information. Set of pixel is utilized for feature forecast instead of using distinct pixel value. The spatial and translation invariance of CNN works effectively for spatially linked data such as soil quality.

CNN is utilized to extract the arrangement concealed in soil surface for hyper spectral data. Modelling complex relationship and representing nonlinearities from a very large scale data is solved by using deep learning. This research focuses on soil texture prediction using CNN.

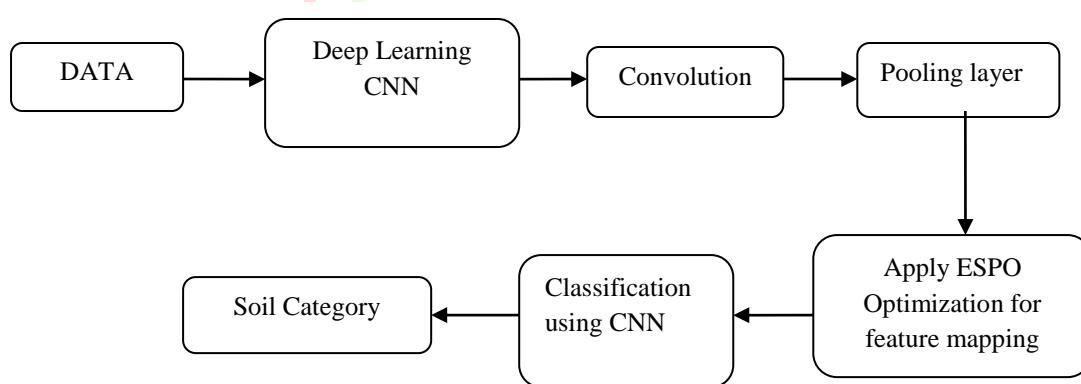


Fig 1:- Overall Frame work of proposed System

Initially, the input data is divided into training and test sets respectively. Minor portion of training data is arbitrarily experimented from training set. Later this would be sent through the evolutionary step of PSO. The chief motive behind utilizing this minor subset aims to minimize the execution cost. This is because CNN always consumes less time and memory. It is not necessary to change the entire network; PSO is

exploited to develop the ideal Dense Block on the minor subdivision. The proposed strategy loads the Dense Block repeatedly in order to create an established CNN architecture.

**2. DNN:-** A DNN consists of input layers, hidden layers and output layers. When there are numerous hidden layers then it is a deep NN or deep learning. The hidden layers captures the non-linear relationships among the input and the corresponding output, and the number of hidden layers is based on the complication of the problem being solved. There are different types of deep learning methods which are intended for different purposes.

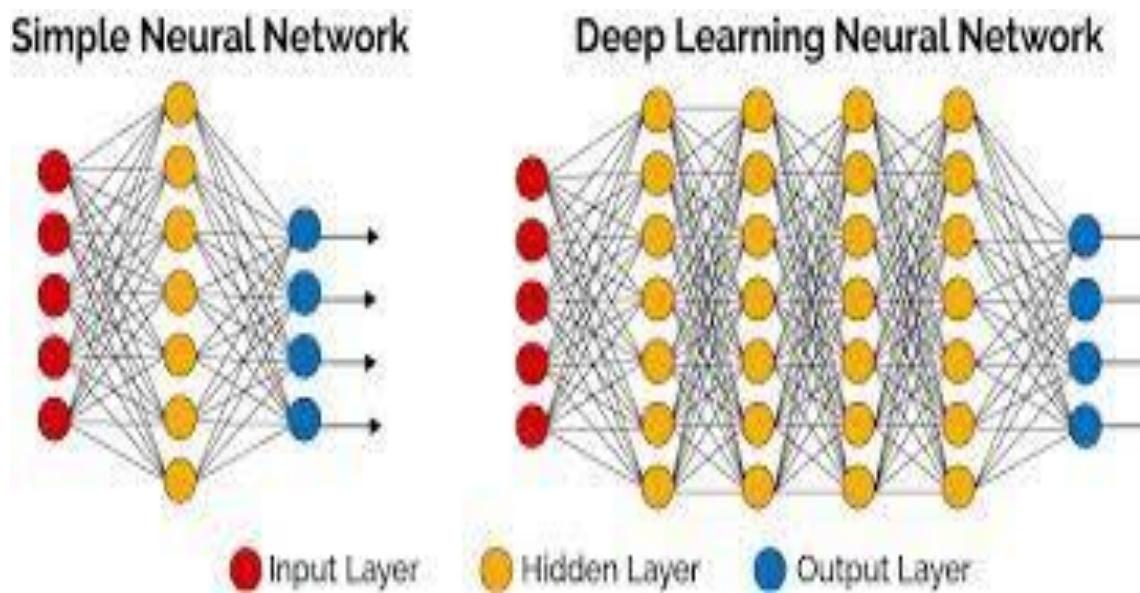


Fig 2:-Simple and deep neural Network Architecture

### 3. Soil Moisture Sensor:-

Soil Moisture sensor is used to measure the moisture content present in the soil. When the soil moisture value read by the sensor is above the threshold value, low level (0V) will be the digital output and if it is below the threshold level, high level (5V) will be the digital output. The digital pin is used to directly read current soil moisture value to see if it is above threshold or not. The threshold voltage can be regulated with help of potentiometer.

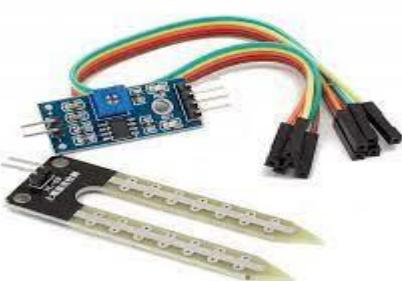
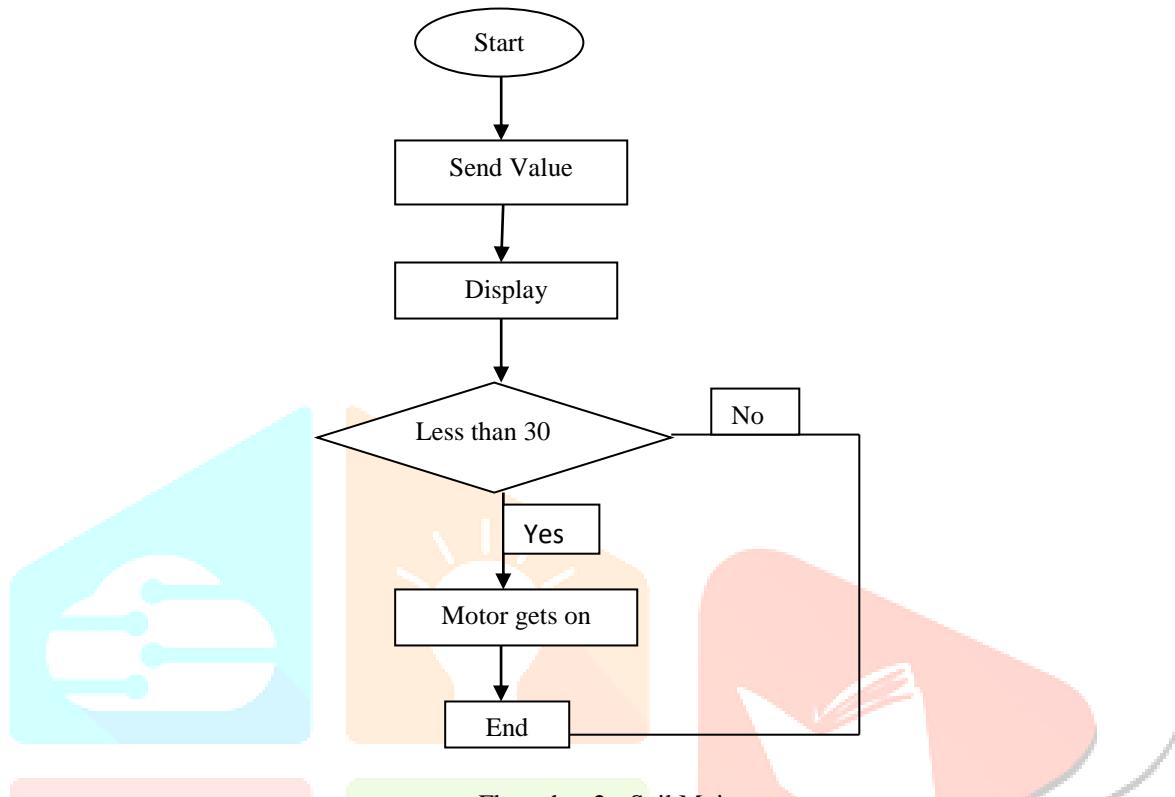


Table3:-Soil Moisture sensor Specification

Input Voltage	3.3-5V
Output voltage	0-4.2V
Input Current	35MV
Output Current	Both Digital and Analogy



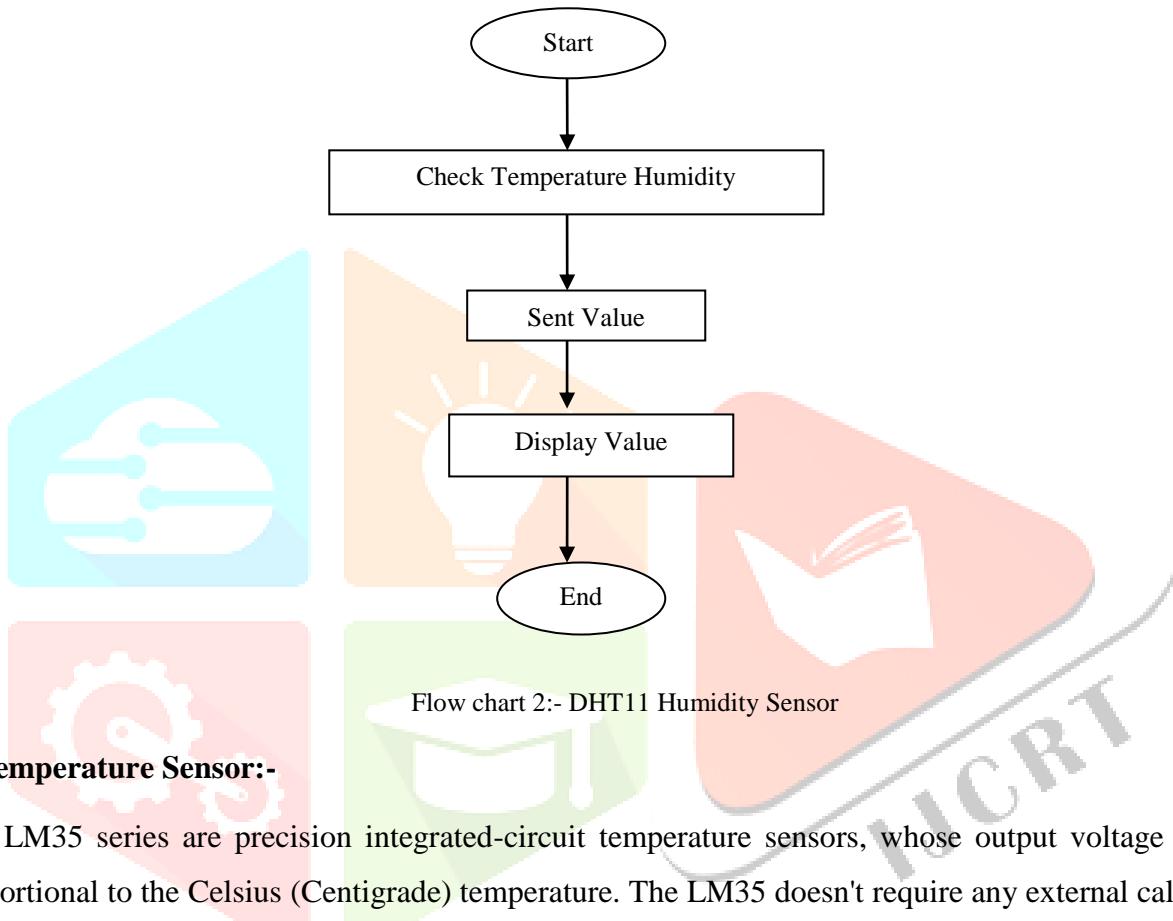
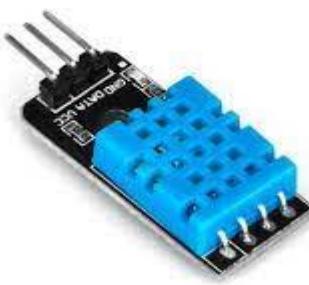
#### 4. PH Sensor:-

PH is the measure of acidity or alkalinity of water solution which is determined by the relative number of hydrogen (H<sup>+</sup>) or hydroxyl (OH<sup>-</sup>) ions present. The pH value (below 7) is said to be acidic and (above 7) is said to be basic. The pH of a solution can change with temperature respectively.



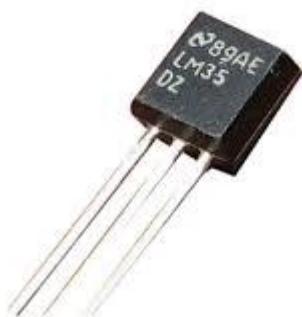
#### 5. DHT11 Sensor:-

DHT11 sensor is used for measuring temperature and humidity. It uses a capacitive humidity sensor and a thermostat to measure the surrounding air. This sensor is cost effective, provides low power consumption and up-to 20 meter signal transmission is possible.



## 6. Temperature Sensor:-

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 doesn't require any external calibration or trimming to provide typical accuracies.



## Features:-

Calibrated directly at ° Celsius (Centigrade)

1. Linear + 10.0 mV/°C scale factor
2. 0.5°C accuracy guarantee able (at +25°C)
3. Rated for full -55° to +150°C range
4. Suitable for remote applications
5. Low cost due to wafer-level trimming
6. Less than 60µA current drain
7. Operates from 4 to 30 volts
8. Low self -heating, 0.08°C in still air
9. Low impedance output, 0.1 W for 1 mA load.

Table 2:-LM35 Temperature Sensor Specification

Serial No	Crop Name	Temperature	Moisture
1.	Rice	21-37	20-25
2.	Wheat	10-15	14-20
3.	Bajara	20-38	20-25
4.	Sugarcane	19-35	15-20

## 5. Result:-

The results of the experiment showed that the moisture stress applied in the intelligent irrigation system completed the phonological period of the plant faster, and due to the earlier harvest of the field, irrigation water consumption was reduced by 35%, but water productivity decreased. Nearly, 22,000 data objects have been taken that includes the notable properties such as proportion of moisture content in soil, proportion of its chemical properties. In proposed method predict the most related parameter is Coarse, clay, Silt, clay, pH(CaCl<sub>2</sub>), pH(H<sub>2</sub>O), EC, OC, CaCO<sub>3</sub>, P, N, K addition to all these, Lucas also covers the reflectance spectra that ranges from 400 nm to 2500 nm, referred to as hyper spectral data. The spectral resolution of the practical sensor is 0.5 nm.

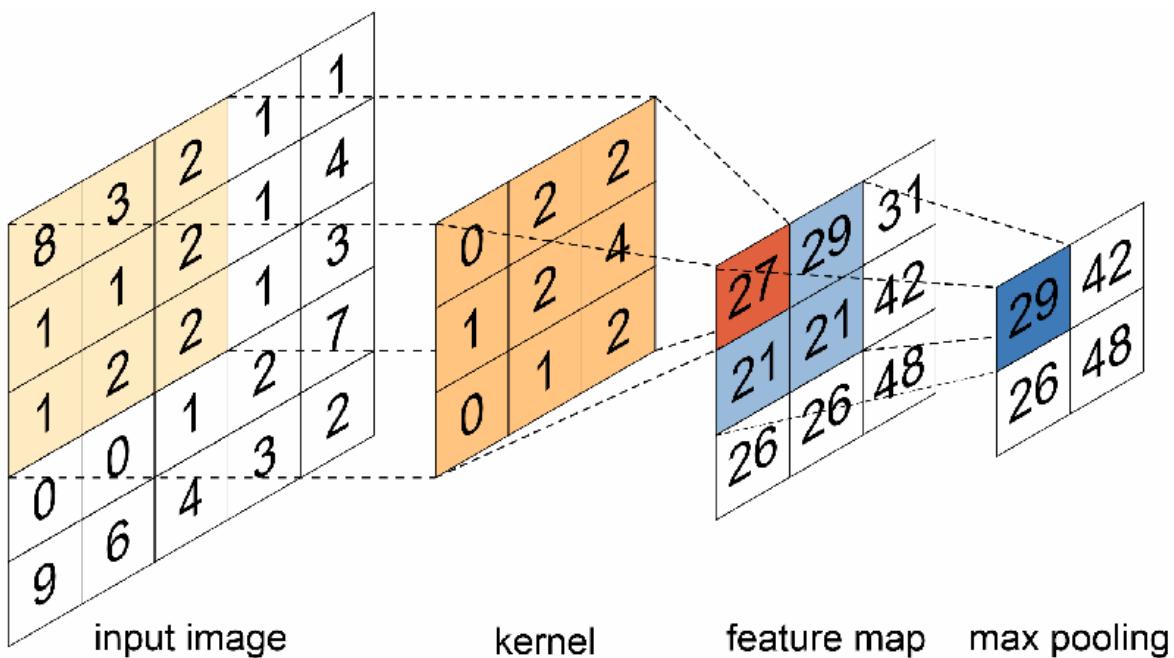


Figure 1

Decomposing	Global CNN	Sqrt p local CNN			CNN-DNN
		Average	Minimum	Maximum	
Type A 2*2, del=0	0.7818 (0.7821)	0.5091 (0.5381)	0.4867 (0.5164)	0.5352 (0.5605)	0.7669 (0.8071)
Type A 2*2, del=0	0.7818 (0.7821)	0.5620 (0.6063)	0.5353 (0.5786)	0.5862 (0.6390)	0.7808 (0.8343)
Type A 2*2, del=0	0.7818 (0.7821)	0.5983 (0.6053)	0.5785 (0.4760)	0.6149 (0.6629)	0.7973 (0.8448)

Table 1

Classification accuracy values for the validation and the training data (in brackets) for the global

## Discussion:-

The Technology of smart Irrigation System results in less water green farming can increase the yield and quality of its crop. Sensor based control is done through Computer Display and Computer Agriculture is Similar sector. This is more dependent on water. Smart Irrigation System can increase the efficiency of Irrigation. Helps in reducing wastage of water. Farmers can increase crop production and income even in the face of water shortage. And with micro Irrigation, crops can be grown with less water. Farmers are very much in need of the outside machineries to run their farm without any distraction in the middle, without any water scarcity. This work will help farmers to reserve the water for later use, though the scarcity of the water is there in that region also by following this technique water could be sufficient for growing plants. Sensors are used to detect the water level. Proper planning and necessary machines which is of low cost has to be used which benefits the farmers. But the limitation of this work is, it is used only

for small farms because sensors whatever is been used will detect the moisture level for certain distance or for certain area. If we want to detect for more areas one has to use more number of sensors and the reservoir for storing of water. Future more sensors enabled in one board can be developed to place it in an area and a bigger reservoir to collect the water and motor pump capacity which is of higher voltage can be used such that water can be pumped throughout the farms in a better and efficient manner.

## 6. Conclusion:-

Smart Irrigation System is a objective make it more innovate user friendly, time saving and more efficient than the existing System. It has five measure, Water level, DHT11 humidity, Temperature, Soil Moisture, etc. Water used for Irrigation and to control water. With this, farmers can do farming. Know about can know natural. IOT for farming has a big impact on smart farming. In this, relay with motor connects output, soil moisture and humidity sensor etc. have been used with CNN and DNN. Water is produced in this. Farming is done with water. In Node Mcu with CNN and DNN, Motor pump work as output device. This system helps the farmer by working automatically and smartly. With placing multiple sensors in the soil, water can be only provided to the required piece of land. This system requires less maintenance so it is easily affordable by all farmers. This system helps to reduce water consumption. With using this system the crop production increases to a great extent.

Sensors	Sensor value range
Soil Moisture	-10dC to +85dC
DHT11	Temp -55dC to +150dC Humidity 40 percent
PH Sensor	6.5 to 7.5

## Future Scope:-

In The process of providing sufficient amount of water to the agricultural land through Smart Irrigation System, it is very beneficial in reducing the drought conditions for the cultivations of grains. Farmers Relay on Natural Rain. The Smart Irrigation System has the following Sensors, Soil Moisture, Temperature, and DHT11 Humidity, PH, Water Level, etc are used. And this requires Technical Compound. Relay Switch, Motor Pump, Computer Sytem has been installed. This system can be the more Arifical intelligent system which predicts user actions, nutrient level of the plants, time to harvest, etc. With CNN and DNN algorithms more advancement can be done in the future which will help farmer a lot and water consumption can also be reduced in agriculture. We can do agriculture with smart Irrigation System. There are three types of Agriculture. Monsoon Crops is grown June to November, Winter Crops is grown December to May, Zaida Crops is grown December to March, etc can be irrigate with water smart irrigation system.

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