**Question 1: Swimming Pools**

Water flow Control System Using Machine Learning , Neural Network & IOT :

Index Terms: IoT, machine learning, neural network, prediction, sensors, storage pool, water flow, weather meter , water pump.

Input Data (Feature List) – temperature per minute, humidity per minute , water level sensor (per minute) , water hardness , pump scaling , rate of change of water level , pump flow rate

Output (Target Class)- pump performance.

**Internet of Things (IoT)** : it is one of the most trending technology used to connect the sensors and devices to the internet. IoT is the networks which connects devices with the internet and share the data with the user. These sensors continuously emit data which provides the working state of the devices .The IoT platform integrates the collected data from various sources, further analytics is performed on the data and valuable information is extracted as per the requirements.

**Neural Network** : It consists of several inputs called neurons which are associated with their weight that signifies its influence and strength with the interconnected neuron. The data is transferred from the input to the output via transfer function. The neural network consists three layers of interconnected neurons. The neurons of each layer are connected with each other. The input layer stores the data and the output layer responds to the input given. There is a intermediate layer which is hidden in between the input and output layer which performs the computation on the data.

**System Architecture :**

The proposed system consists of number of digital sensors such as pipe water sensor, level sensor, controller etc. which are connected to the NodeMcU controller. A GSM module is present in the microcontroller to communicate with the phone or other devices. The system is installed in the residential swimming pool to monitor the water level. The sensors continuously transmit the data to the controller. The data is collected in the database and the result is sent to neural networks to analyze the data.

Key Components :

1. Pump Water Sensor

Senses presence / absence of water in pipe and passes signal to the controller for start or stop pump. Sensor not in direct contact with water, hence maintenance free. Non-corrosive engg. Plastic (hard water resistance)

1. Controller- Works on auto / Manual mode
2. Level Sensor

Auto on /off of pump through sensing the water level in overhead tank.

No salt deposition on sensor, hence maintenance free. Automatic tank level control

**Implementation :**

HARDWARE IMPLEMENTATION The system consists of a microcontroller named as NodeMcU. It is inexpensive controller made with the chip known as ESP8266.It has the Wi-Fi module to easily connect with the user and share the predicted result. In the proposed system, the water pump sensor, level sensor ,weather meter are connected to NodeMcU. These sensors collect the data from the water and send out the wave signal to the cloud server that collects the data from the gateway and store it in the database for analysis. The data collected is further used for predicting the of water flow control in advance using neural network algorithm.

SOFTWARE IMPLEMENTATION The software used for implementation was Matlab in which neural network algorithm was used to predict the result. Neural network are the better ways to analyze and modeling the data. It processes the data in interconnecting neurons. The model has one input layer, a hidden layer and a output layer. Data collected thru hardware set up are passed through networks to generate outputs. The target output is obtained in the training phase. The data is divided into training, testing and validation.

CONCLUSION :This system save the cost of overflowing water by controlling water flow