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Proposed Model for SWMS Using ANN and IoT

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Abstract: Artificial Neural Network is having accurate predictive capabilities. Its predictive power can be used to predict the amount of solid waste. Knowing the predicted total amount of solid waste, Municipal Corporation can arrange the number of human resources as well as financial budget for number of vehicles, container, dustbins etc. for proper management of solid waste. Internet of Things further can be used in solid waste management system for knowing the level of garbage in the container as well as its transportation. Now days there is a good scope for IOT, various embedded devices are available. Today everywhere we see the picture of garbage container, full of garbage spreading odor and diseases in the city. Using proper methods and embedded devices, we can build the effective system for solid waste management.
Keywords: Artificial Neural Networks (ANNs); Solid Waste Management System (SWMS); Neural Network (NN); Solid Waste (SW); Internet of Things (IoT).

I. INTRODUCTION

A. Artificial Neural Network

Neural Network developed long year back. But it got popularity from 1980 onwards due to drastic change in hardware and software development in the market. Neural network can be used best way with existing traditional technique to get the appropriate result.
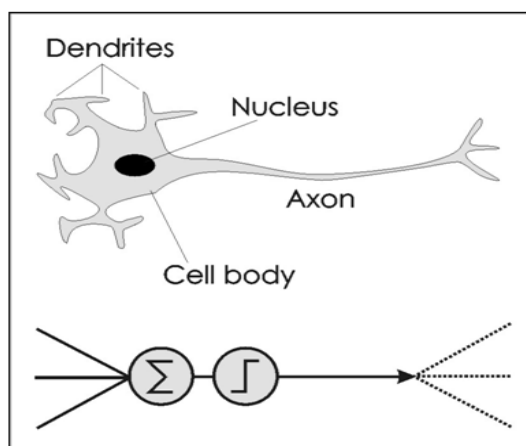
Source [1]Figure 1.1schematic comparisons between a biological neuron and an artificial neuron

Above diagram explains us the working difference between biological neuron and artificial neuron. From above example we can understand the working of any Artificial Neural Network. In the initial days statistical methods were used for the prediction of solid waste, stock exchange and pattern recognition by the researcher. But later on due to ANN's accurate predictive capabilities and very fast learning ability it was mostly used in time series prediction. A neural network can be used to solve linear as well as non-linear programming tasks. Generally the structure of ANN is of three layers that is Input layer, hidden Layer, and output layer. Input can be given through input layer. Number of Neurons is present in input as well as in hidden layer. Hidden layer is having processing functions. Output can be obtained from output layer through activation function.

B. IoT

Many embedded devices which are connected and controlled by internet is called as IoT. Now day's use of IoT is increased in research area. It is used in Transportation, Solid waste management, Shopping, Road traffic control, Health monitoring projects, Academic project as well as in various government projects. Various embedded devices like Modems ,MPEG decoders, Network cards, Network switches/routers, On-board navigation, Pagers, Photocopiers, Point-of-sale systems, Portable video games, Printers, Satellite phones, Scanners, Infrared sensor, radio frequency identification RFID etc. are used in IoT concept.
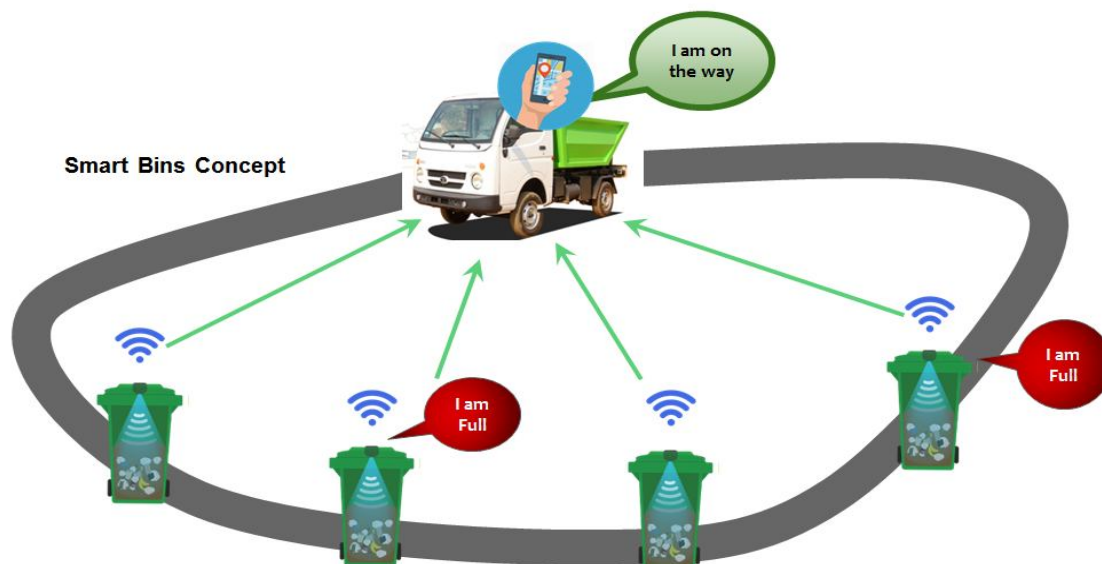
Fig1.3   source- Smartbin Sensors – BioEnable

Above diagram explains how IoT works in Solid waste management system.

II. LITERATURE REVIEW

Artificial Neural Network is used in many research problems for various reasons. In case of solid waste management it plays very vital role due to its capabilities of prediction.ANN used to predict the amount of solid waste accurately in the city.ANN used for short term prediction as well as long term prediction. Mr J. Sudhir Kumar, K. Venkata Subbaiah, and P. V. V. Prasada Rao[2] have calculated the predicted solid waste amount for Elluru city for the year 2010 upto 2026.They have used four factors 1. Population of MCE 2. MSW generated at MCE 3. Percentage of urban population of the nation and 4. GDP per capita of the nation. Mr. Vatsal Patel and Mr Srinivasarao Meka[3] used slightly different factors like i)MSW Generation Present year ii) Population iii) Social factor iv) Economic factor v) Longitude vi) Latitude. Mr. Maleerat Sodanil [4] uses amount of monthly solid waste was collected between October 2002 and July 2013, a total of 130 months gathered from the DOE. Mr. Mohammad Ali Abdoli, Maliheh Falah Nezhad, Reza Salehi Sede, Sadegh Behboudian [5] uses i)Population ii) household income, and iii) maximum temperature are assumed as the effective factors on SWG in Mashhad. Literature review shows that for any city it is important to consider following factors i)Population of city ii)Socio Economic factors iii) Monthly generated solid waste etc.A survey made by Ruhin Mary saji and Drishya Gopakumar [6] on Smart Garbage management in the cities using IOT. They have mentioned the various devices which have been used in the garbage management in the city for example ultrasonic sensors to detect the level of garbage in the dustbins. Infrared sensor IR sensor which can detect the level of garbage. Further he[6] mentioned about the GSM modem which will triggered as soon as the garbage reaches the threshold level .

A.   Proposed SWMS system Using ANN and IOT

In India, population is increasing day by day so rate of solid waste generation is also increasing. Municipal Corporation in India is facing the problem of proper management of solid waste. Main factors like i)Population ii)Economic Factor iii)Generated solid waste are very important factors for designing the solid waste prediction model in India. Data have to be collected on the basis of per capita per year. It is very difficult to manage the data on above factor for last 10-15 years. While designing the Artificial Neural Network model for prediction of amount of solid waste, MATLAB can be used to generate the output. We have to provide dataset belongs to various factors as a Input. We got output through activation function.

Once Municipal corporation come to know the yearly predicted amount of solid waste through ANN model, decision can be taken that how many number of container will be placed in the city? Further IOT plays important role to detect the level of garbage in the container. As soon as the level of garbage reached in the container, embedded devices comes in to play and gives signal to the Municipal corporation authority through internet. Municipal Authority suddenly takes the action to transport the garbage containers to dumping site and a fresh empty container will be placed immediately. In this way   odor and spreading of diseases in the city can be avoided and It also reduces the cost on SWM.
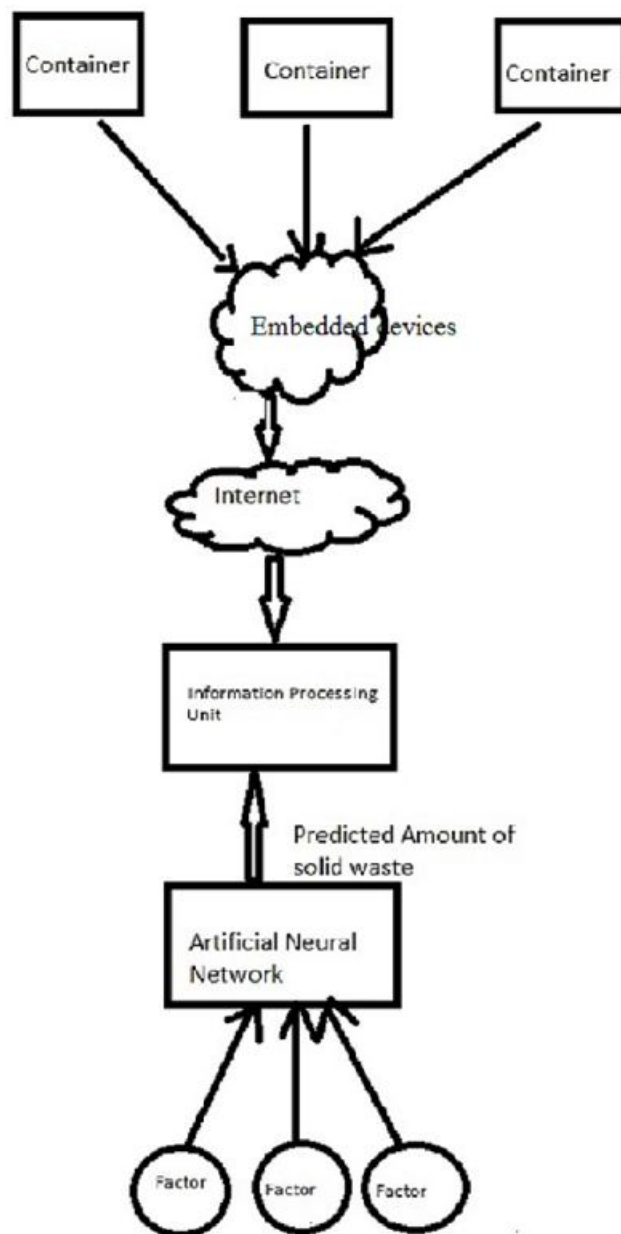
Proposed SWMS system Using ANN and IOT

Fig 1.2.Proposed SWMS system Using ANN and IOT

III. CONCLUSION

We have designed a proposed system for solid waste management using ANN and IoT. Before implementing a SWMS for any city it is very essential to calculate the budget. Financial budget as well as human resources can be calculated only after the amount of solid waste will get known by the Municipal Corporation in advanced. So prediction of SW in the city is very essential. We have used ANN for prediction of SW in the city. In the next part of proposed system IoT plays important role to detect the level of garbage in the container. As soon as the level of garbage reached in the container, embedded devices comes in to play and gives signal to the Municipal corporation authority through internet. Municipal Authority suddenly will take the action to transport the

garbage container to dumping site and a fresh empty container will be placed immediately. This system will reduce the cost on SWM and also bad odor and spreading of diseases in the city can be avoided.

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