Bengalathon – Solution Concept Note

Attempted Challenge:

SMART WATER METERING

Challenge Description:

AI-ML enabled Smart water metering to monitor water usage across areas and raise alarm in case of excessive and/or continuous water usage in a particular area.

Proposed Solution Name:

Real-Time Water Monitoring using IoT and Machine Learning.

Brief Background of Proposed Solution:

The given solution proposes an Artificial Intelligence System basically a mobile application to be built on for monitoring water levels in public and private water tanks and for alerting users and corresponding authorities if there's a sudden rise or drop in water level. The given application will contain the following features:

- Live water level in the IoT fixed water tanks
- What is the water level in the previous days and weeks? (Daily Report and Weekly Report)
- The system will be able to predict the water level in the upcoming days using Machine Learning algorithm known as " Linear Support Vector Regression ".
- The proposed system will be able to find the quality of the water in the water tank also.

Objective:

- To monitor the real time data from the IoT devices fixed in the water tank.
- To alert the users if there's a sudden drop or rise in the water level.
- To predict the water usage for upcoming days.
- To reduce the wastage or over usage of water in public or private areas.
- To find the quality level of water in the water tank.

Brief Description about the Concept:

The proposed system uses the concept of IoT for gathering the data, binning for analyzing the data in efficient manner and Machine Learning for predicting the data.

- The water tank gets fixed with 3 types of sensors namely Ultra-sonic sensor, Turbidity sensor, pH sensor and NodeMCU Wi-Fi module which give data about the water level, water quality level and pH level.
- The data is collected for every 1 minute and getting stored in the cloud and it is used for analysis of the water level and quality measurements.

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- The proposed model collects the data from the cloud in the interval of 1 hour and starts processing. It uses a technique known as binning which groups the large volume of data into certain points i.e., for every 1 hour, the model gives 3 mean points.
- To reduce the IoT error, the proposed model finds the peak factors and removes it.
- The proposed application will also predict the water level for upcoming days using a Machine Learning algorithm known as " Linear Support Vector Regression " which converts the non-linear plane into linear plane and performs the linear regression on it.
- The resulted graph will be stored as .jpg image file in the Firebase.
- The proposed mobile application will fetch the image files from the Firebase server and display it.
- The most important feature of the proposed model is to alert the users whenever there's a large deviation in the water level.
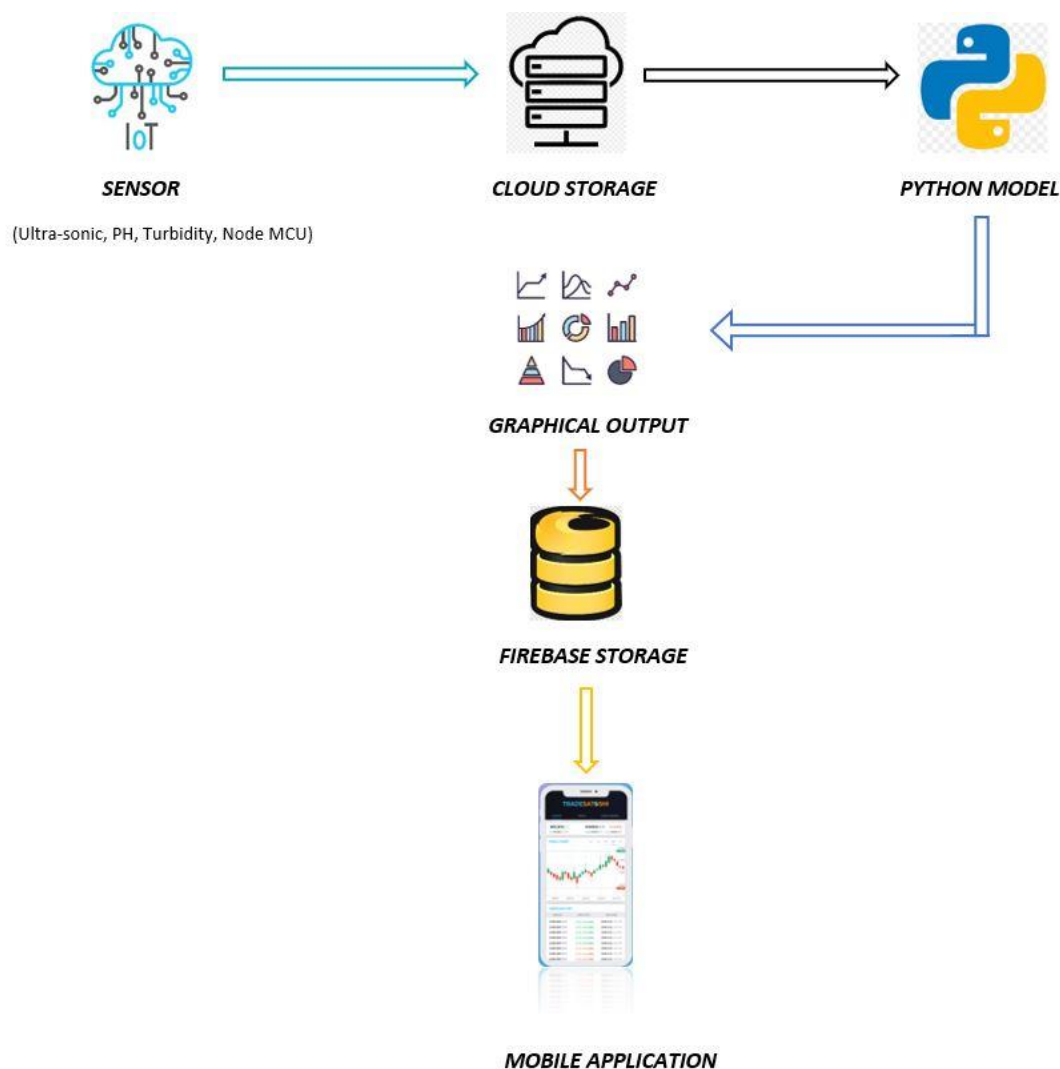
The Work Flow of the Proposed Model

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Expected Outcomes:

- The user can able to know the water level, quality and water usage of their water tanks.
- The user can get alert messages whenever there is an excess usage or wastage of water from their water tanks.
- The system can be able to predict the water usage which helps user to plan accordingly.
- The main outcome of the proposed model is to reduce the water scarcity in the upcoming days.

Water Level Monitoring Sensor Setup in Water Tank

Graphical Output of the Proposed Model:
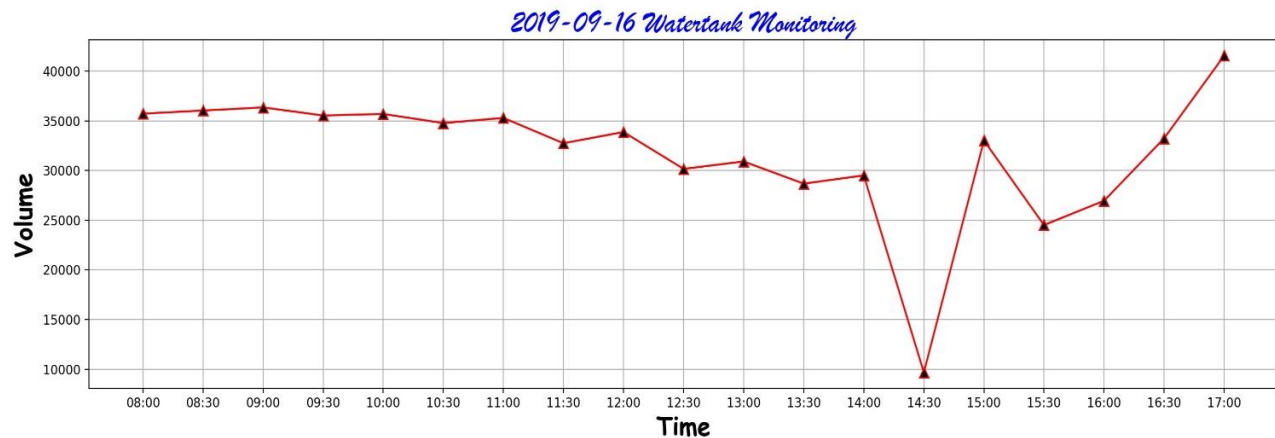
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Risk and Mitigation Plan:

The major problem in the sensors is that they can give improper data due to some natural disturbances like wind flow, etc. To reduce this type of error, the proposed model includes the concept of peak deduction and reduction. The other possible risk is that whenever the sensor gets damaged, it doesn't give any data. To indicate this type of physical error, the proposed model contains automatic alert system which alerts the user whenever more than certain number of null values are received.

Revenue Model:

The only thing that requires money is IoT kit. The average cost that requires to build our model is Rs. 3,500 for monitoring water level alone. If it includes water quality measurement also, then the average cost will be Rs. 7,000.