Aquaculture Monitoring With Machine Learning Technique

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Abstract - **In this era of science and technology machine intelligence has wide range of scope. It can be used to improve the production in various fields. Agriculture is one industry in which machine intelligence is expected to have significant impacts. Research in this area is new but growing rapidly; so, expert system researchers and practitioners are always struggling to keep pace with research progress in this region. This paper reports on a systematic review of research in the application of Machine Intelligence. Moreover we are implementing Machine Intelligence to increase the production of fishes by monitoring the properties of water as well as environment. There are various factors to be monitored such as pH value, dissolved oxygen, salinity, temperature etc. which is responsible to maintain favorable condition for the water ecosystem. Hence continuous monitoring of data read through sensors make farmers easy to maintain the suitable condition. This leads to the increased production in aquaculture. To this end, therefore, there is still the need for more research to better understand, characterize and evaluate and implement the utility of Machine Intelligence in agriculture. This leads to the significant improvement in the production to fulfill the demands of the population. Also, advanced use of Machine Learning based aquaculture leads to the automation in monitoring which absolutely improves the production.**

Keywords: machine intelligence, aquaculture, sensors, production, water, properties, salinity, oxygen.

I. INTRODUCTION

With the rise of technology, machine learning and artificial intelligence has taken a broad scope to monitor the parameters and process the data and make it easy for farmers and people to monitor the environment. Among these, aquaculture monitoring using the data read from sensors makes the farmers easy to understand the problems and manage it accordingly to increase productivity. The model is based on the data taken from the various sensors like pH sensor, Nitrate sensors, anemometer, temperature sensors etc. On the basis of data collected from sensors can map the relationship between the monitored data and the standard data and maintain the environment accordingly. The traditional system of

monitoring the aquaculture is based on work experience and knowledge about the species of fishes which may not be always reliable. Hence use of machine intelligence is more advanced and reliable. The real time data is processed to the cloud through raspberry pi. The data then can be fetched from the cloud database and be visualized on the live website. Most significantly, real time monitoring helps to maintain the environment specifically for the particular species of fish.

II. METHODOLOGY

The process initially starts from the data taken from the sensors such as nitrogen sensor, pH sensor, temperature sensor, humidity sensor etc. The data is processed with the algorithms in the raspberry pi. Later on it is sent to the cloud database. We are using Google firebase as the repository for cloud data. The website is built and hosted over firebase where it fetches the data from the real time database in the cloud with the help of APIs and then displays to the user. Here, farmers are the user who views the data from various different ponds remotely and maintain the environment accordingly. Different methods are used to monitor in the real-time water quality. To make sure that safe distribution of water is done, it must be observed in real time for a new method in the "Internet of Things (IoT)" based water quality has been projected. Real-time water quality observation is examined by data acquisition, method, and transmission with an increase in the wireless device network method in the IoT. Microcontroller and the processed values remotely to the core controller ARM with a WI-FI protocol are used to interface the measured values from the sensors. This projected the water quality observation interface sensors with quality observation with IOT setting. WQM selects parameters of water like temperature, pH level, water level and CO_2 by multiple different device nodes. This methodology sends the information to the web server. The data updated at intervals within the server may be retrieved or accessed from anyplace within the world. The main goals of this research were reached and the examples of the application of machine learning models are presented, covering most of the aspects of the average research working in the field of artificial intelligence for environmental sciences tasks. This work also reveals the importance of consulting data scientists before starting of the monitoring, since data sets unsuitable for requested tasks is a

common problem. The physical and chemical properties of water are collected and recorded in data base and further sent for analysis the prediction of water contamination is achieved using machine learning algorithms. Neural network algorithm was used to predict results. The system sends the alert message to the user if there is unusual change in water than the standard properties of water.
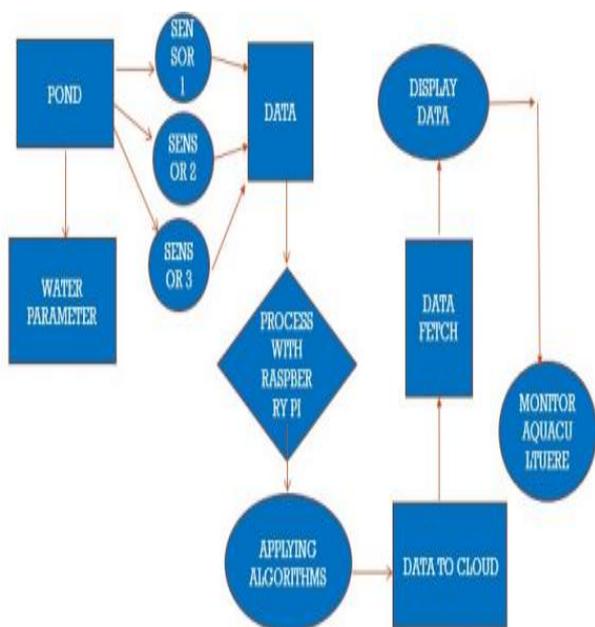

Figure 1: Block diagram

The above architecture shows the structure of the system. The sensor reads the data from water and is processed by the raspberry pi by applying machine learning algorithms like KNN, SVM. The processed data is sent to the cloud database. A website is hosted that accepts the cloud data through the APIs and displays to the end user. The present system of aquaculture monitoring is manual based. The farmers have to go the pond to see the status of the fishes. Similarly, they have to carry different tools manually to see the dissolved oxygen, salinity, nitrates which are the vitals to maintain the favorable conditions for the fishes. This is time consuming and not effective for large locations in different cities. There are different locations and these different locations have data uploaded to the cloud through raspberry pi. The farmer can remotely view the data through the real-time website. The real time data is taken through the sensors. These data are processed to the firebase cloud through WIFI module. This solves the manual monitoring of data by the farmers which was not effective and was time consuming. This leads to the improved monitoring that leads to increased production.

2.1 Hardware Specification

- Raspberry pi
- PH sensor

- Temperature sensor
- Nitrate sensor
- Anemometer
- Optical DO sensor
- Light sensor

2.2 Software Specification

- VNC server
- Cloud database
- Cloud hosting for website
- Text editor software like sublime text etc.
- Python and html, Css, JavaScript.
- Web browser
- Web APIs

III. DATA FLOW DIAGRAM

The below diagram shows the order of the process. Firstly, sensors implementation is made where the data is taken. After that the data is processed by the raspberry pi by applying some machine learning algorithm.
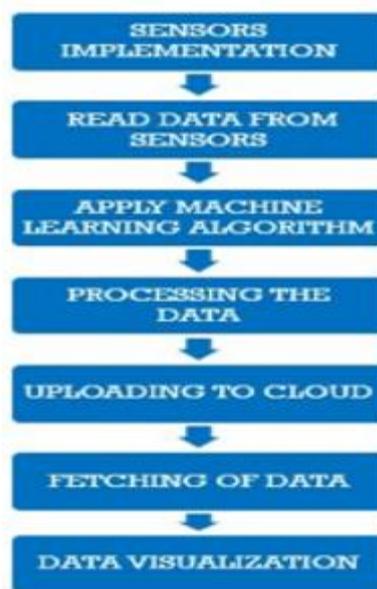

Figure 2: Flow diagram

Since raspberry itself is capable of pushing data to the cloud, it is stored to the cloud database. Later on is displayed on the website and is monitored by farmers.

3.1 Module Description

The application is overall divided into three modules:

3.1.1 Module 1

This is the first module. In this module the sensors read the data and send to the raspberry pi which is operated with VNC

server. The sensor data is processed in this module. There may be inappropriate and noise data which is handled by the raspberry pi.

3.1.2 Module 2

This is the second module where the data is pushed to the real time database in the firebase. A python script is run in raspberry pi where machine learning algorithm is implemented. Then the data is pushed to the real time database in cloud.

3.1.3 Module 3

This is the final module where the data is visualized to the end users. Website is built which fetches the data from the cloud database and is displayed in the dashboard. The aquaculture can be monitored by looking the data displayed on the website which is previously sent to the cloud from the sensors.

IV. FEASIBILITY STUDY

4.1 Economic Feasibility

It is feasible in sense of cost. It reduces the cost required to the human resource to perform activities manually. A single person can monitor aquaculture environment remotely across different places.

4.2 Technical Feasibility

Our proposed system is to remotely monitor the aquaculture. Since technology has become more popular and everyone owns a smart phone and internet. The environment can also be viewed remotely over the internet since the data is provided in the internet. Hence it is technically feasible.

4.3 Social Feasibility

This application is socially justifiable. It is simple product based service for the farmers to monitor the aquaculture online. This is strong platform in terms of trust among the farmers. Only the little knowledge 6 is required for its operation. In other word a person who can operate smart phone can easily use it to monitor the aquaculture.

V. STANDARDS AND POLICIES

- IS 13587: (1992) Computer system configuration diagram symbols and conventions for information processing systems [ISO 8790]
- IS 13615: (1993) Service definitions for the association control service element in open systems interconnection for information processing systems [ISO 8649]

- IS 13672: (1993) Application layer structure in open systems interconnection for information technology [ISO/IEC 9545]
- IS 13675-1: (1993) Remote Operations in Text Communication for Information Processing Systems, Part 1: Model, Notation and Service Definition [ISO/IEC 9072-1]
- IS 13675-2: (1993) Remote operations in text communication for information processing systems, Part 2: Protocol specification [ISO/IEC 9072-2]
- IS 14638: (1998) Information technology - Software product evaluation - Quality characteristics and guidelines for their use [ISO/IEC 9126]
- IS/ISO/IEC 90003: (2004) Software engineering - Guidelines for the application of ISO 9001: 2000 to computer software.

VI. CONCLUSION

This model helps to monitor the real time data of the pond and make farmers easy to maintain the absolute condition required to increase the production. The real time water and environment parameters can be monitored remotely by applying machine learning algorithms. Data read from the sensors is pushed to the cloud from where the user can view remotely. This is cost effective and requires less manpower to operate. Hence, it is effective to monitor aquaculture in many locations.

VII. FUTURE ENHANCEMENTS

There is huge possibility of automation in the aquaculture in near future. Since machine intelligence is new topic and still has more implementation, in the near future this monitoring could lead to automation where the human monitoring is not even required to operate and maintain the environment through automation.

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