

Automatic Detection of Under Water Wastage on Pond Using Artificial Intelligence and Wireless Sensor Networks

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Abstract- Pollution in aquatic environment is an evolving risk in ecosystems since it leads to negative impacts in ecology and contaminates the entire environment. Water get polluted in many forms such as through industries, oil manufacturing companies, domestic sewages or by fertilizers used for agriculture. Such water pollution endangers underwater species and affects the health of human beings. Water play a major role in the transportation of non-degradable wastes to oceans which brings deadly diseases worldwide. Water bodies are facing an uncertain future around the globe. To reduce the risk of water pollution, rigorous monitoring is needed to identify the sources of pollutants. Many existing studies have concentrated on measures to avoid water pollution, but, lacked with effective surveillance systems for capturing the area being polluted. Hence, the proposed work focuses on monitoring from both the upper layer and lower layer of the pond through CCTV and underwater sensors for pollutant detection. CCTV detects for wastes that float on water and sensors predict the underwater wastes. Both forms of collected information are sent to the tower through Wireless Sensor Network (WSN) which reports the condition of pond through mobile devices. The CCTV based detection system uses the YOLO framework for detecting the hotspots for optimal evacuation processes. The proposed framework exhibits its efficiency in the form of accurate monitoring and broadcasting enhanced images or videos when predicted. Thus, the enhanced model designed for identification of plastics, polymers or any other types of wastes on pond reduces water pollution effectively.

Keywords: Pond, Pollution, CCTV, WSN (Wireless Sensor Network), YOLO (You Only Look Once), Plastics, Underwater Sensors, Environment, Monitoring, Evacuation.

1. INTRODUCTION

Water has the major role in the sustainability and development of all living things around the world. The

quality of water affects the social and economic development of society. When water becomes contaminated or being polluted by unwanted substances, it leads harmfulness to the entire environment. Based on the study [1], the leading causes of pollution are involved with the solid and non-degradable wastes, sewage releases into the pond and discharge of domestic emissions into the pond. The indiscriminate discharge propagates serious health implications affecting the life of humans as well as aquatic species. The main causes of pollution occurs normally from the dumping of waste refuses and industrial effluents. Such kinds of waste discharges leads to negative impacts on chemical, physical and biological factors of environment. Contaminations over the surface water and the ground water affects the quality of the fresh water in ecosystems.

The pollutants causing damage to the water destructs the community and deteriorate the aquatic environment. The suggested study [2] on the issue of pollution in pond water has taken steps in monitoring the polluted area through accurate estimation and transfer of those polluted data from the pond to base station. The system of monitoring has provided energy efficient tracker with the utilization of deep neural network for the identification of sewages. It has utilized knowledge distillation process for training the compressed deep neural network. Such kinds of compressed networks have been effectively used for the deployment of limited energy conserving resources and has achieved accuracy at a considerable rate. The study has employed game theory based technique for the estimation of the time duration taken for the transmission of those pond water related data. The utilization of game based theory approach in the study has reduced the consumption of energy thereby

ensuring the faster transmission of predicted polluted information to the base station. The experimental and real world evaluation has been performed for demonstrating the effectiveness of the study.

The quality management on natural resources is significant and hence the suggested study[3] has aimed on the development of system which has monitored the quality of the water through many parameters which has been considered as safe for both humans as well as for the ecosystem that lives in pond. WSN has been utilized in this study for monitoring the underwater wastes. The underwater sensor node has been attached with many types of sensors like temperature, oxygen level and electricity. The pond water inspecting model has been designed for monitoring the level of water and their rate of flow for alerting the environment. Even though studies have focused on the concept of monitoring the pond water to avoid pollution, the pollutants released in pond not only be dropped under water, it also has been thrown away on the surface of pond. Hence, to detect waste on both the surface layers and under water, the proposed system uses the CCTV and sensors for capturing the image of the area when it is polluted.

2. OBJECTIVE

The main aim of the study is to mitigate the water pollution through efficient detection mechanism for pollutant deposits in pond water through wireless sensor network. The main objective of the study is as follows,

- To detect the polluted area on the surface layer of pond water through CCTV that sends immediate images or videos to the base station using YOLO framework.
- To detect the underwater polluted area through underwater sensors by reporting the sensed information to the base station.

3. BACKGROUND

The life of animals, humans and plants are purely based on water and hence it is very important for protecting the ecosystem. Importance of water is increasing rapidly. The higher increase in population and the limited sources of water together have been considered to be the main causes for the need of water. So it is very important for the society to protect the

water sources from being polluted by various factors. In order to alleviate pond pollution, certain forms of technological advancements are needed for inspecting the particular area, repairing the polluted area and also for maintaining the place to make the environment pollution free. It is also important for preventing the illegal connections from the sewage pipelines straight away to the natural pond. Such illegal connection monitoring can help in the prevention of pollution. Economic development through industrial growth which has been operating along the sides of the pond creates pollution due to the wastes released from those industries. This system assists for the protection of water resources through effective real time monitoring. The proposed study utilizes the sensors for measuring the water parameters. Consideration of data from the sensors are regarded for making useful decisions to remove the polluted and unwanted wastes being deposited over the water. It mitigates the water being polluted and prevent from the infection being spreadthrough water.

4. SIGNIFICANCE

The proposed study is intended to mitigate the pollution being created in pond water. The proposed system uses CCTV and Underwater sensor methods for detecting the polluted area and sends information about the polluted data to the mobile devices. This system is highly helpful to the Government ministry of environment for making effective decisions on evacuating the solid wastes being deposited over the pond and controls pond water pollution effectively.

5. METHODOLOGY

The proposed work uses the detection mechanism in pond water. It utilizes two forms of detection techniques such as through,

- CCTV on upper layer of pond
 - Underwater sensor in under water layer of pond
- CCTV uses the YOLO technique that uses the neural network for recognizing the objects through framing the objects that are detected. The underwater sensor deployment technique for effective surveillance of solid wastes and non-degradable sewages being deposited under the water. The field installation along the barrier coverage determines the solid pollutant elements that are moving under the water. The initially

captured data are being stored in the benchmark datasets and are also capable of collecting images of non-biodegradable images on real time. Those collected data will be pre-processed in the way of resizing the images being captured and undergoes the image enhancement process through multi-scale fusion methodology. This kind of enhancements is useful for images being captured during dark or rainy weather. It is followed by the deep learning algorithm computation through YOLO which trains the model and classifies the waste particles that has been floating or being deposited in water. The overall framework of the proposed study is given in Figure .1

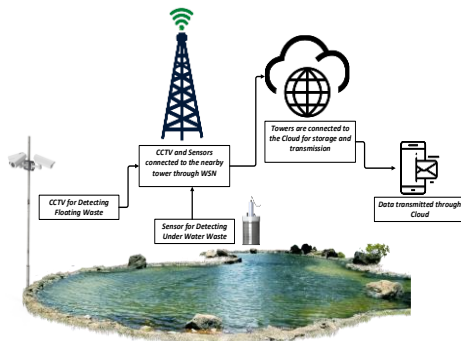


Figure.1 Overall Architecture diagram of the Proposed Methodology

computation as mentioned in Figure.2 helps in mitigating the pond water pollution through YOLO detection method for effective prediction of wastes on pond.

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Yolo detection on Pond:

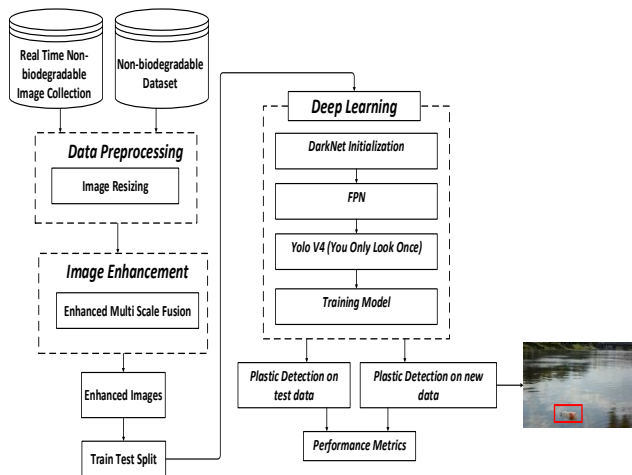


Figure.2 YOLO detection

The data collected from CCTV and sensors from underwater are sent to the base station or to the nearer tower through wireless sensor network. The towers are connected to the cloud for storage and transmission. The polluted data being gathered from both the sources are transmitted to propagate through the mobile devices. The effective prediction and