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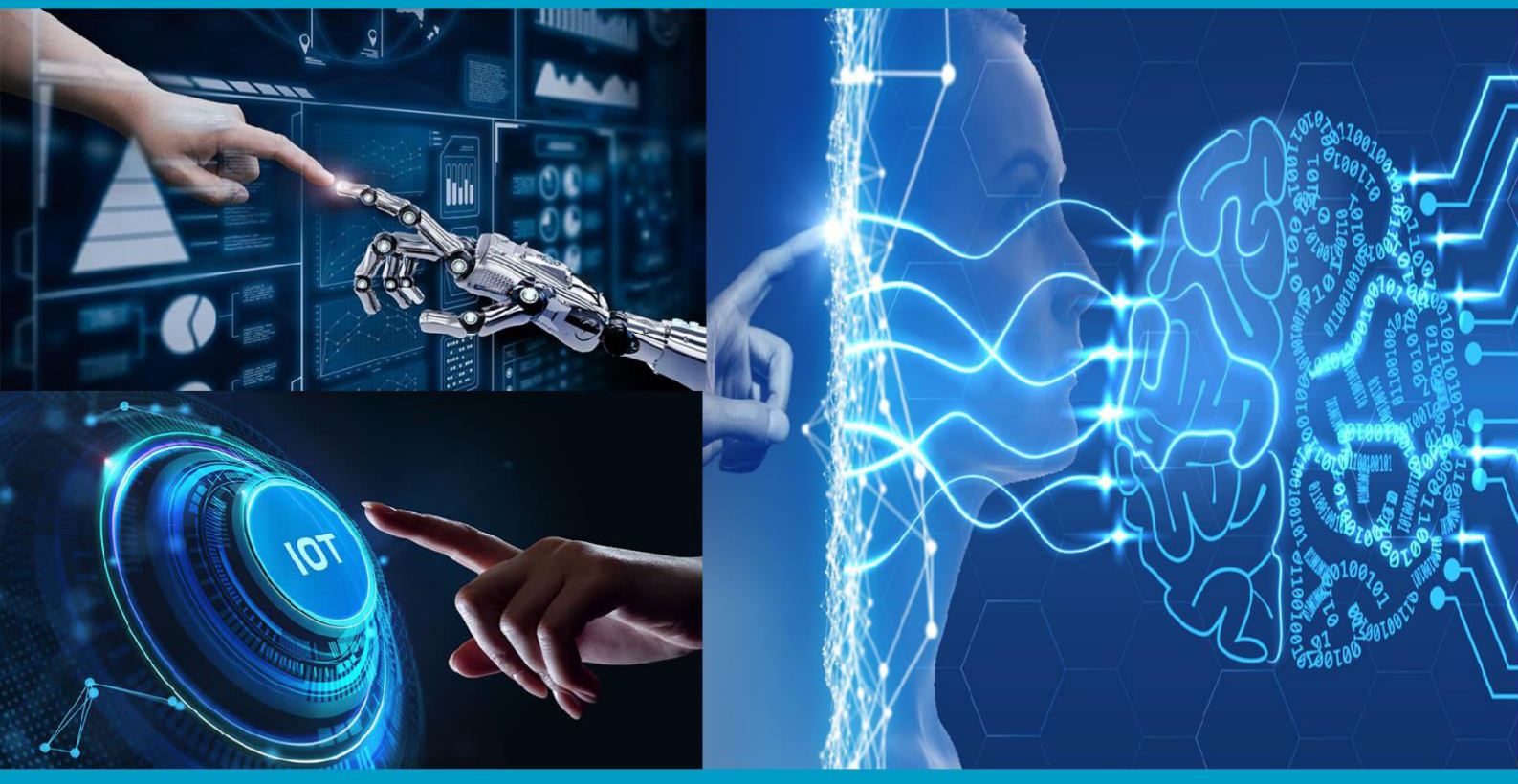

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IOT Based Water Monitoring System

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ABSTRACT: This project presents a novel real-time water quality monitoring system designed to detect insects and monitor water levels simultaneously. The system integrates computer vision techniques employing a Convolutional Neural Network (CNN) algorithm for insect detection through on-camera analysis. Concurrently, it utilizes sensors to monitor and track water levels in the targeted environment. The insect detection model, implemented via CNN, employs deep learning to recognize and classify various insect species within the water body. This real-time analysis provides immediate feedback on the presence of insects, contributing to early detection of potential water contamination or ecosystem disruptions. The water level sensors capture and monitor the dynamic changes in water levels. This data is processed and analyzed in real-time to provide accurate information regarding water depth and fluctuations, crucial for environmental monitoring and management. The system is designed to provide alerts through visual and audio cues upon the detection of insects or significant changes in water levels. Visual alerts include on-screen notifications or indicator lights, while audio alerts notify users through designated sounds or alarms. This integrated approach to water quality monitoring offers a comprehensive solution for early insect detection and precise water level tracking. The combination of CNN-based insect detection and sensor-based water level monitoring provides valuable real-time information, empowering users with timely alerts to safeguard water quality and ecosystem health.

I.INTRODUCTION

Water quality and ecosystem health are critical aspects of environmental sustainability. Monitoring and maintaining water quality parameters are essential for safeguarding ecosystems and ensuring the availability of clean water resources. Insects, often indicators of environmental health, and water levels are key factors in assessing the condition of aquatic ecosystems. This study introduces a novel real-time water quality monitoring system that employs advanced technological approaches to detect insects and monitor water levels simultaneously. Leveraging computer vision techniques, specifically a Convolutional Neural Network (CNN) algorithm, the system aims to identify and classify insects through on-camera analysis. Concurrently, the system incorporates water level sensors to monitor and track dynamic changes in water depth. Accurate and real-time monitoring of water levels is crucial for understanding environmental fluctuations, flood prediction, and sustainable water resource management. This dual approach information, empowering users with timely alerts to safeguard water quality and ecosystem health. combining insect detection through computer vision and water level monitoring via sensors aims to offer a comprehensive solution for assessing and maintaining water quality in aquatic environments.

II.EXISTING SYSTEM

In this existing system is water level monitoring system for Arduino UNO its monitor the water level in ultrasonic sensor. IOT (Internet of Things) based water monitoring systems such as tank water level sensing monitoring and water leakage monitoring has been proposed. The water level of the society tanks from which the water is being supplied to the flats. When the water is being supplied there will be a time when one of the flat will consume less water in 24hr or the force/pressure of water in that flat will be minimum as compared to other flats and from this we will come to know that the pipeline of that particular flat has some defect. This will be using leakage detecting module or sensor which will detect the leakage (if there), also it will be using the pressure sensors for calculating the pressure of the water coming from the main tank to per flat. And will use turbidity sensor to detect the turbidity of water.

III.PROPOSED SYSTEM

The proposed system comprises a multi-sensor setup interfaced with an Arduino Uno microcontroller to facilitate real-time water quality monitoring. The system integrates a high-resolution camera for on-site image capture, enabling insect detection through a Convolutional Neural Network (CNN) algorithm. Simultaneously, an ultrasonic sensor is

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employed to monitor water levels within the aquatic environment. The Arduino Uno microcontroller serves as the central processing unit, orchestrating the data acquisition from both the camera and the ultrasonic sensor. The captured images from the camera undergo real-time analysis via the CNN algorithm, identifying and classifying various insect species present in the water body. This analysis provides crucial insights into the environmental health of the aquatic ecosystem, detecting potential contaminants or disturbances. Concurrently, the ultrasonic sensor continuously measures water levels by emitting ultrasonic pulses and calculating the time taken for the pulses to reflect back.

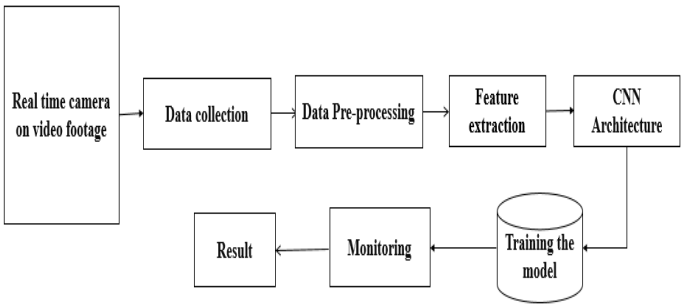

Figure.1. Block Diagram

The Python Integrated Development Environment (IDE) interfaces with the camera to capture real-time video footage of the aquatic environment. Through libraries like OpenCV, it continuously collects video frames, forming the basis for data input into the system. The collected video frames undergo pre-processing steps to enhance their quality and prepare them for analysis. This involves tasks like resizing images, normalizing pixel values, and potentially applying filters or transformations to ensure consistent input data quality. Within the Python environment, the pre-processed video frames are fed into the Convolutional Neural Network (CNN) architecture. The CNN model extracts intricate features from these frames, recognizing patterns and shapes within the images that are indicative of different insect species present in the water. The CNN algorithm, implemented using libraries like TensorFlow, goes through a training phase using labeled datasets of insects. It learns to distinguish and classify various insect species based on the features extracted during the training process. Through the Python IDE, these results can be monitored and displayed in various formats, such as graphical representations or textual notifications. Users can observe the identified insect species and their abundance, aiding in assessing the water quality and potential environmental disturbances. The system's output comprises the real-time detection and classification of insects visible in the video footage.

The high-resolution camera serves as the visual input source for the system. It captures real-time images or footage of the aquatic environment. These visuals are then processed using a Convolutional Neural Network (CNN) algorithm to detect and classify insects present in the water body. The camera's role is pivotal in providing the system with live data for insect detection. This sensor is responsible for monitoring water levels within the environment. It works on the principle of emitting ultrasonic pulses and measuring the time it takes for the pulses to reflect back. By analyzing this data, the sensor can determine the water depth and track changes in water levels. It provides crucial information for environmental monitoring and flood prediction. Acting as the brain of the system, the Arduino Uno microcontroller coordinates and processes data from both the camera and the ultrasonic sensor. It manages the interaction between these components, processes the incoming data, and executes the insect detection algorithm for real-time analysis such as the presence of specific insects or significant fluctuations in water levels. The buzzer alerts users audibly, drawing immediate attention to potential environmental concerns or anomalies detected by the system. mechanism integrated into the system.

IV.HARDWARE COMPONENTS

Arduino Uno

The Arduino Uno is a popular microcontroller board that serves as an excellent entry point for beginners and a versatile tool for experienced electronics enthusiasts, makers, and engineers. It is a part of the Arduino family of microcontroller boards, known for its simplicity, ease of use, and wide range of applications. The heart of the Arduino Uno is the ATmega328P microcontroller, which is based on the AVR architecture. This microcontroller provides a good balance of processing power, memory, and I/O capabilities for a wide range of projects.

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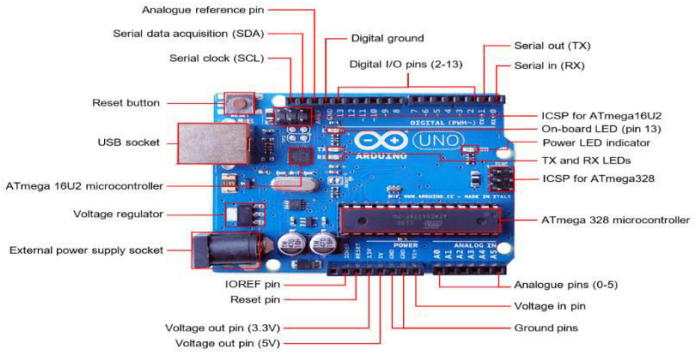

Figure.2.Arduino UNO

Ultrasonic Sensor

Transducers that convert ultrasound waves to electrical signals or vice versa are known as ultrasonic transducers. Ultrasound transceivers are those who can both send and receive ultrasound; many ultrasound sensors, in addition to being sensors, are also transceivers since they can sense and transmit. These devices operate on a similar basis to transducers used in radar and sonar systems, which evaluate target properties by reading echoes from radio or sound waves, respectively. Active ultrasonic sensors create high-frequency sound waves and analyse the echo that is returned by the sensor, determining the distance to an item by measuring the time gap between transmitting the signal and getting the echo. Passive ultrasonic sensors are essentially microphones that detect ultrasonic sounds in specific settings, convert it to an electrical signal, and report it to a computer.

Figure.3.Ultrasonic Sensor

Liquid Crystal Display

A liquid crystal display (LCD) is a flat panel display, electronic visual display that makes advantage of liquid crystals' light modulating characteristics. Liquid crystals do not directly emit light. LCDs can display random graphics (as in a general-purpose computer display) or fixed images that can be displayed or concealed, such as pre-set text, numerals, and 7-segment displays like those seen in digital clocks. They both employ the same fundamental technology, with the exception that arbitrary pictures are composed of a vast number of little pixels, whilst other displays contain bigger parts. An LCD display is a compact, low-cost display. Because of the inbuilt controller (the black blob on the back of the board), it is simple to interface with a microcontroller.

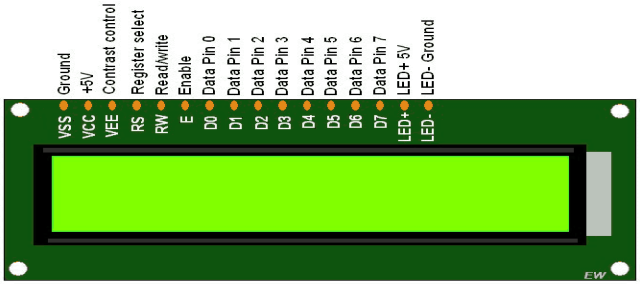

Figure.4.LED Display

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Buzzer

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board.

Figure.5.Buzzer

V. SIMULATION OUTPUT

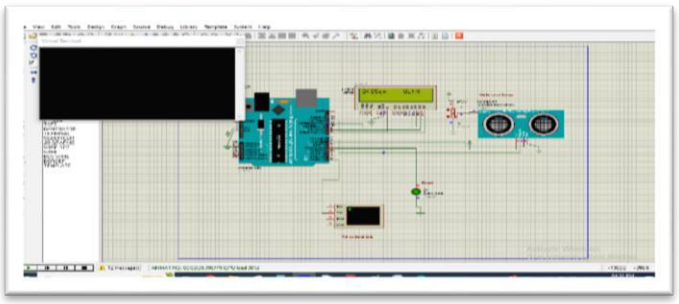

Figure.6.Simulation Results

The integration of a real-time water quality monitoring system employing CNN-based insect detection, sensor-driven water level monitoring, and alert mechanisms presents a pivotal advancement in environmental monitoring technology. This innovative system offers a comprehensive approach to assess and safeguard aquatic ecosystems. By leveraging computer vision through CNN algorithms, the system enables early detection of insects, acting as bioindicators for potential environmental stressors. Concurrently, the sensor-based water level monitoring provides essential data for understanding dynamic changes in the aquatic environment. The system's ability to provide real-time alerts through visual indicators and auditory cues empowers users with timely information to address emerging environmental concerns. This immediate response capability aids in pollution prevention, water resource management.

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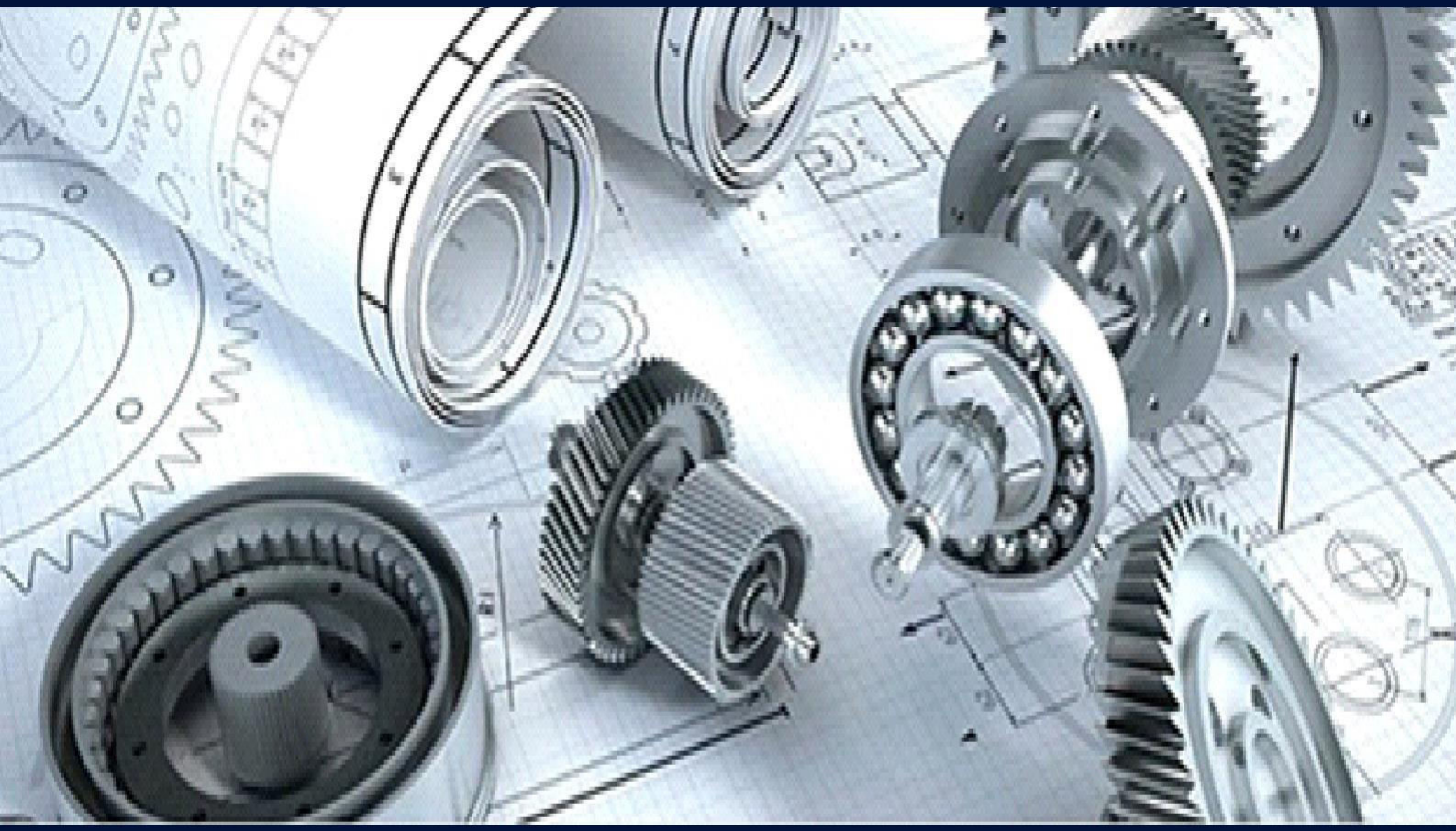

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