BOAT SURVEILLANCE AND CLASSIFICATION OF FISH USING NEURAL NETWORK

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Abstract- *Fishery is one of the most major sectors. The fishing process involves high risk factors such as the safety of fishermen are in danger due to unpredictable weather changes and other external or environmental factors, also collection and segregation of fishes are tedious. The main objective is to provide safe and secure environment to fishermen, making the fishing process easy. Here, the images of fishes are captured by the use of camera at the time of collection and are segregated depending upon their size and weight which is preloaded in the raspberry-pi 3 microcontroller. The fuel level of the boat is continuously monitored by the means of level sensor and indicated through LED and buzzer. The Global Positioning System (GPS) is used in emergency situation by sharing the exact location of the boat to both fishermen and Navy force. To identify the obstacles under water, ultrasonic sensor is used. The RF module, transmits and receives radio signals between boat and acts accordingly, if it nears the border. To detect the unnatural vibration, weather condition and load condition the respective sensors are used such as vibration sensor, humidity sensor and load sensor. The data collected while performing the above-mentioned processes are stored in real time cloud and are displayed in the monitor.*

KEYWORDS: Raspberry Pi 3 microcontroller, RF Module, Real time cloud, GPS, Ultrasonic sensor.

I.INTRODUCTION

Indian fisheries and aquaculture are a significant part of nourishment creation giving healthful security. The fisheries area assumes the significant job in the monetary improvement of the nation. The conventional angling process is less proficient since security of anglers is under risk. Additionally, assortment and isolation of fishes are as yet a dull procedure. Logical examinations on species arrangement and wealth dissemination of fishes have significant significance to the fishery business, biodiversity security, and marine biological system. In these investigations, pictures of fishes are ordinarily gathered with the assistance of scuba jumpers or self-ruling submerged vehicles. These pictures are then explained physically by sea life scientists. Such a procedure is positively an enormous misuse of labor and material assets. Here we use Machine Learning calculation which characterizes fish pictures consequently and screen the pontoon route and furthermore climate checking.

With technology advancing in modern society, people have significantly better discovery and understanding of our world. While, an increasing number of explorers worldwide are attracting abundant ocean resources which are newly discovered. Therefore, effective methods and techniques should be introduced for detecting and estimating fish quantitative distribution, such as the image-based fish classification, to provide a good environment to the fishes, as well as the Marine ecology. By classifying fishes based on size and weight, also detecting unnatural vibration in boat using vibration sensor and to detect unknown objects under water and to predict both weather and load conditions. Boat Navigation is done by using RF Tags and GPS Location sharing which prevents the fishers from border crossing and alert the marine force.

II.SYSTEM DESCRIPTION

This project consists of fish classification, Boat Border crossing monitoring and Environment Monitoring section. The overall block diagram as shown in Fig-1. The fish classification section consist of camera which is connected with the Raspberry Pi 3 controller, the camera is activated with the help of Ultrasonic sensor and the images of captured image and they are compared with the database and then the fishes are compared with the database and then the fishes are separated based on their images. RF transmitter and receiver used to monitor the border crossing of the boat and indicate through LED and buzzer and also share the location to the marine force. Environment monitoring section consists of Digital temperature and Humidity (DHT) sensor and vibration sensor which is used to detect the rain and also the vibration sensor is used to avoid the boat collision by indicating the wave speed and the whole operation is monitored and controlled by the use of Internet of Things(IoT).
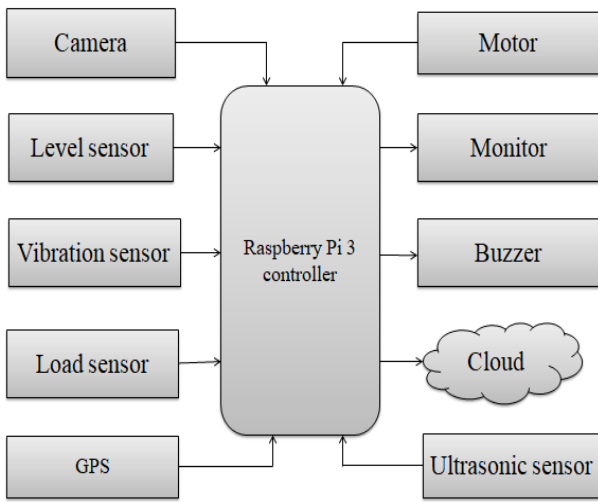
Fig-1: Block Diagram of boat surveillance block diagram

III. FISH CLASSIFICATION SECTION

The fish classification section consists of Camera which is connected with the Raspberry Pi 3 controller. In this process the images are trained in to the database, the trained data such as images of fishes based on size, color and features are preprocessed by the use of feature extraction and classified using classifier. Ultrasonic sensor is placed so as to detect the fish and activates the camera. The camera captures the images of collected fish and compared them with the trained data set.

The following processes for fish classification, they are

- Training data processing
- Data acquisition
- Preprocessing
- Fish identification

A. Training data processing

To identify several fish species and remember our agreement that any given fish is either included in the vector of fish categories. Let's identify a (probabilistic) variable that describes the state of nature.

A feature is some attribute of the object that is consider important in describing and recognizing the object in relation to other objects. Color, size, shape, texture, head, number of fins are some widely used features the aim in this stage to find relevant information in different factors. That deal with large quantities of information. It shows a feature-model matching that demonstrate the sections interest of our model. In the end of this step, the probabilities inter-species is processed, and probabilities a priori have been generated.

B. Data acquisition

The underwater platform is designed to detect and monitor optical signals over and extended deployment. The machine is able to take videos are image sequences in the input.

C. Preprocessing

Frame analysis requires preprocessing whatever the noise acquired in the capture. Thus, this noise should be eliminated. The purpose of this part is to enhance the visual appearance of the image, in order to improve the manipulation of raw frames. If we look on the underwater images we can consider two big problems: smoothness and noise. Of that, we use a preprocessing method. In this method, the underwater world as overlaps of two processes. The first method is known as a Poisson distribution, while the second one is regarded as a Gaussian mixture. The resulting distribution is called Poisson-Gaussian mixture (PGM).

D. Fish identification

It's done using Artificial Neural network (ANN). ANN is not that far from our glorious biological system in their most simple definitions. They are composed of input channels, units and output channels. An artificial network describes the interaction of many units. A single unit (also called neuron) consist of one or more real valued edges as input, an integration function which process the inputs and produce a value passed to an activation function that fundamentally computes the output of the unit. The process is shown in Fig-2.
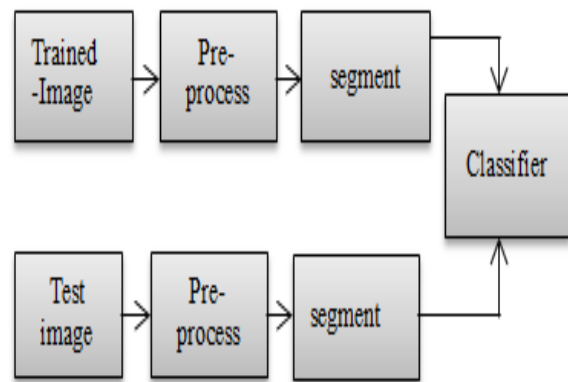

Fig-2: Block diagram of fish classification

There are three types of images used in Digital Picture Processing. They are

1. Binary image
2. Gray scale image
3. Color image

Binary Image

A binary picture is digital image which consist of only two possible values for each. Usually the two colors used for a binary image are black and white but any two colors can be used. The color utilized for the objects in the image is the front color while the rest of the image is the background color.

Gray scale image

A gray-scale image is a digital image in which a single sample is the value of each pixel, that is, it only carries information about intensity. Such images are distinct from one bit black and white images which in the sense of computer imaging are images with only the two colors black and white (also called bi-level or binary images). These images are often called monochromatic denoting the lack of any chromatic variation.

Color image

A color image is a digital image for each pixel that includes color information. Every pixel has a specific value that decides its appearing color, that value is determined by three numbers giving the color decomposition in the three main Red, Green, and Blue colors, that way any color that is visible to the human eye can be portrayed.

For Quantity Measurement here we used the ultrasonic sensor (SR-04). Ultrasonic sensor provides identification and range of very short (2cm) long-range(4m). With very high accuracy, the sensor provides precise and stable non-contact distance measurements from around 2cm to 4m. A module of ultrasonic sensors can be used to measure distance, sensor of objects, motion sensors etc. Using a microcontroller, highly sensitive module can be integrated with motion circuits to make robotic projects and other items sensitive to distance, location and motion. It can communicate comfortably with any microcontroller. Ultrasonic sensor is used to measure the quantity of fish which is present in the container, if it is exceed then indication is given through buzzer.

IV. ENVIRONMENT AND BORDER MONITORING

In an environment and border monitoring section, DHT sensor and vibration sensor is used. The DHT sensor which is used to measure the humidity and temperature level of environment which indicate the fishermen, the daily weather reports. It helps to save the lives of fishermen's life.It reduces work for the fishermen. The fishermen can predict any harmfulness by monitoring the environment with the two respective sensors.

A. DHT sensor

The digital temperature and humidity sensor DHT11 are a composite sensor that contains a calibrated digital signal production of temperature and humidity. The development of a dedicated digital modules array and the temperature and humidity sensor systems was introduced to ensure the product has high reliability and excellent long –term stability. The sensor has a resistive sense of wet component and an NTC temperature measuring tool, and is coupled with a high-performance 8-bit microcontroller.

B. Vibration sensor

The vibration sensor is used to measure the speed of wave that strikes the boat which consist of metal ball as an internal structure that is fixed in a special spring as a pole and around it there is another pole. When the vibration goes beyond their extent, the two poles are connected so as to judge the shock is occurred or not and also it detects any unnatural vibration occurred in the boat. The output signal of Vibration sensor is digital signal. The Operating voltage ranges from 3.3V to 5V. It uses a wide voltage LM393 comparator.

C. RF Transmitter and receiver

A RF module is a small electronic unit for transmitting and/or receiving radio signals between two devices; Wireless communication to another unit within an embedded system is often desirable**.** 433MHz receiver frequency, 105Dbm typical receiver frequency, 3.5mA current receiver. When the boat crosses the border the GPS location is shared to the marine force which secures the fisherman from their attack.

D. The Global Positioning System

The GPS, formerly NAVSTAR GPS, is a satellite-based radio navigation network operated by the U.S government and run by the U.S Air force. It is a Global Satellite Navigation System (GNSS) that delivers geo-location and time information to a GPS receiver anywhere on or near earth where four or more GPS satellite have an unblocked line of sight. Barriers like mountains and buildings obstruct or disrupt the GPS signals.

V. RESULT AND DISCUSSION

In result and discussion section, the output obtained through fish classification, border and environment monitoring are displayed.

A. Imaging pattern

The fishes are being classified based on their geometrical, scaling features and size which helps in prediction of many species and helps in classifying the fishes as small, medium and large.
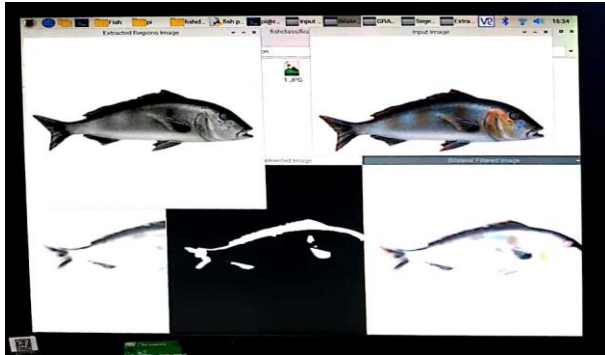
Fig-3: Imaging pattern based on fish classification

B. Rain prediction

Rain is predicted by means of determining the temperature and humidity level by their respective sensors and graphical representation, which provides safety to both fishermen and marine ecology.

Fig-4: Result of Thingsspeaks IoT

Message passing:

To prevent the boat from changing its direction, by means of GPS the current location is shared to both the fishermen and marine ecology as given in Fig-5.
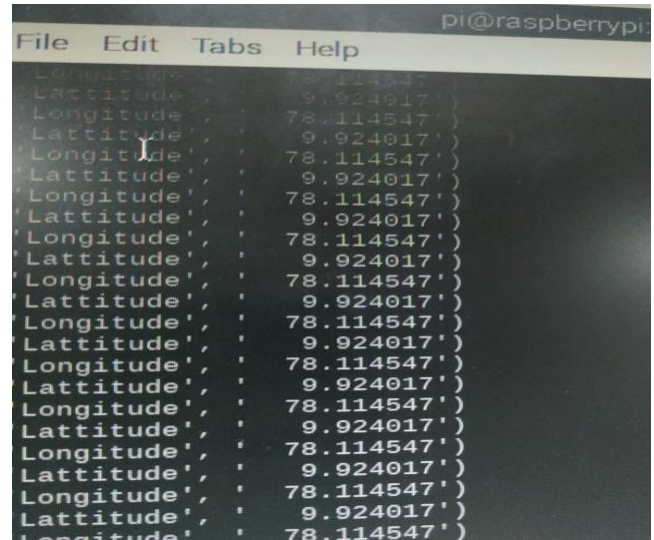
Fig-5: Sharing GPS location

Fuel level indication

The fuel level indication is done through fuel level sensor that indicates the level of fuel in tank which helps to avoid difficult situations.

C. Obstacle Detection

The unknown obstacles underwater are predicted and the boat is protected from being damaged by means of ultrasonic sensor.

D. Vibration prediction

The unnatural vibration in predicted through vibration sensor that helps in reducing wave speed by pumping out oil by the motor.

E. Border Monitoring

RF transmitter and receiver are used to send and receive signals that helps in detecting the border and alerts the fishermen and marine force during emergency situations.

Fig-6: output of border monitoring

Fish Load Classification

The fishes are classified based on their weight and size such as small, medium and large fish by means of load sensor.

F. Hardware Representation

Final outcome of this paper, which is given below as a hardware module in the figure 7. It is useful for better and comfortable boat surveillance and classification of fishes using neural network and also its application provide a safer navigation for both fishermen and marine ecology.

Fig-7: Hardware module

VI.CONCLUSION

We have implemented artificial neural networking to classify the fishes based on their segments to identify the type of fish by means of machine learning algorithm. Safer navigation is provided by means of border monitoring, GPS location sharing, fuel level indication and weather monitoring. The destruction of boat is avoided with the aid of vibration sensor and ultrasonic sensor. Fish classification based on their weight and their load level is provided by load sensor. Thus, the comfortable and sophisticated life is provided for both the fishermen and marine force, thereby providing an ecological and beneficial economy to the nautical ecology.

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