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Early Flood and Victim Detection

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Abstract: Thousands of people die because of earthquake and sometimes because of Tsunamis. The resulting damage can be minimized and lives can be saved if people living in the earthquake- tsunami prone area are already prepared to survive the strike.

The warning systems can reduce the losses, by alerting people and monitors rising water in residential areas and fastest method to monitor flood that will help motorists or road user to avoid problem when flood occurred. Flood is an unavoidable natural disaster across the world, causing heavy flow of traffic and can also cause severe damage to properties and lives. For this reason, we created a flood detection system to monitor rising water level, flow rate and the rainfall density in residential areas. Using ultrasonic sensor, we created flood level sensing device which is attached to Node MCU controller to process the sensor's analog signal into a usable digital value of distance. Each node will update its information in regular intervals and data stored in the Blynk application.

Flood height is determined by subtracting the sensor's height with respect to the floor minus the sensed distance between the sensor and the flood water. Natural disasters can cause losses, both assets and objects can even take lives. Convolutional Neural Network is one of the developments of Artificial Neural Networks for image classification, image segmentation, and object recognition with high accuracy and high performance. Convolutional Neural Network can learn to detect various images according to images from the dataset studied. The user can get real-time information on monitoring floods and victim detection over SMS based service. So to reduce the number of losses, the System is designed for detecting victims of natural disasters using the CNN method.

I. INTRODUCTION

Natural disasters are unexpected events. Natural disasters can result in large losses both assets, objects can even take lives. Therefore, rapid and appropriate disaster evacuation is needed so that victims of natural disasters can be immediately evacuated and rescued, but in the evacuation process there are often obstacles, such as disconnection of telecommunications networks, poor weather conditions, difficulty in accessing victims of natural disasters, and the uneven distribution of the SAR team caused by no information on the location of the disaster victims and the level of damage caused by the natural disaster. Based on these problems, this final project is designed so that the SAR team can find out the victims of natural disasters quickly and efficiently and assist the deployment of SAR teams (Search and Rescue) in the evacuation process.

The system which is built provides accurate result to organizations, communities or individuals who are interested in establishing and controlling flood monitoring and victim detecting systems. Flood is a natural disaster which cannot be stopped but can be predicted totally. Every year, death rate that is caused due to flood increases because of absence of no right system available to predict and the absence of early warning system. To solve the problems mentioned above, this system provides the idea and implementation of a Flood detection system using Internet of Things (IOT) technology.

This paper discusses deployment of rainfall, water level and flow sensor to detect the early flood. The project aims to use image processing techniques to detect the presence of certain objects. Object detection is meant to detect victims of natural disasters with predetermined objects, namely the overall pattern of the human body so that victims of natural disasters can be immediately evacuated and rescued.

II. AIM AND OBJECTIVES

The main aim of this project is to predict early stages of flood by sending messages via Wi-Fi based network. This system aims to reduce the damage caused by flood so that the damage of natural disasters can be immediately reduced.

The objective is to detect human caught in the disaster affected areas and send intimation to search and rescue team. The main goal is that the model to be fault tolerance.

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III. PROPOSED SYSTEM

In this proposed system, the design of a wireless sensor node involves of an Arduino microcontroller, sensors and wireless transceiver. Sensing unit senses the flow of water and its level. The sensor nodes are connected to Arduino and programmed accordingly to transmit information using wireless systems. Each node will update its information in regular intervals and data stored in the Blynk application. The main hardware components are Arduino, rainfall Sensor, Flow Sensor and monitors the level of water each time it reaches the certain level, alerts are given to search and rescue team (SAR).

Based on the implementation and design stages, this research can detect humans. Web camera captures the live images, image preprocessing technique is applied to detect the presence of certain objects. Object detection is meant to detect victims of natural disasters. The device uses CNN method to detect humans from the whole body also the humans from parts of their body, such as half a body. Various human poses can also be detected such as sitting, standing, and lying down and alerts are activated so that victims of natural disasters can be immediately evacuated and rescued.

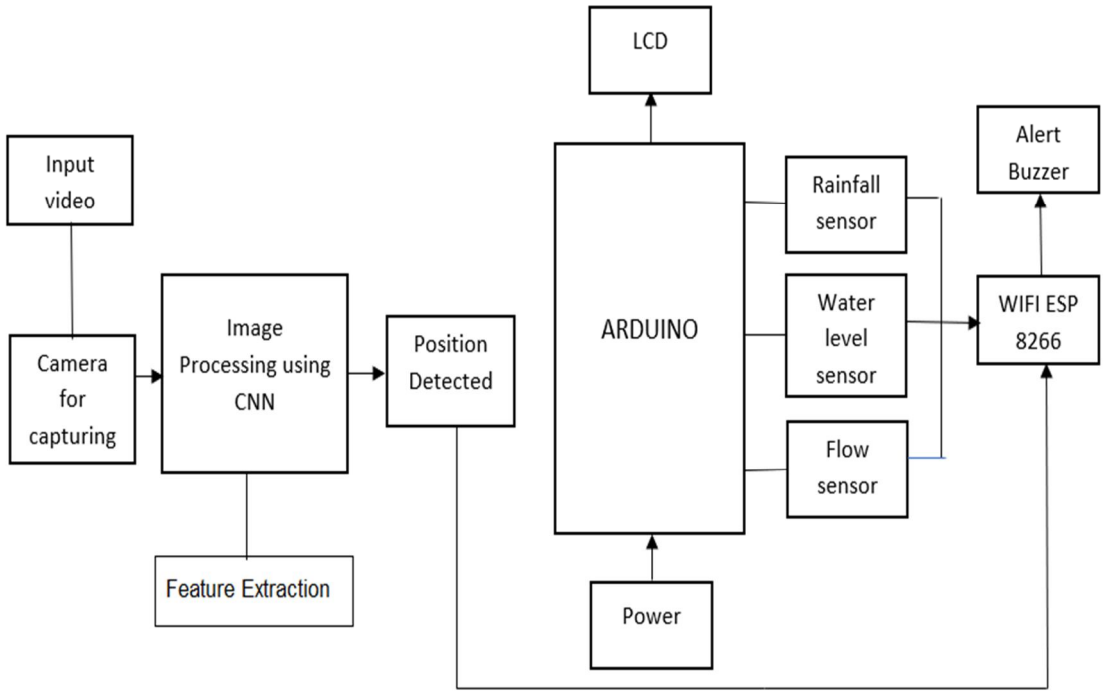


Figure 1: Architecture of Proposed System

IV. LITERATURE SURVEYS

A. Low Cost IoT based Flood Monitoring System using Machine Learning and Neural Networks

This paper was published in the year 2020 by Dola Sheeba Rani, Dr. Jayalakshmi G N and Dr. Vishwanath P Baligar. This paper includes the most advanced technologies like machine learning (ML) provide significant boon to the field of technology in monitoring the normal and abnormal behavioral characters of any machine. The objective of this paper is to survey on flood issues and determine the ML models that yield the best predictive performance for precipitation. The Machine Learning models used to predict the results and to analyses the performance of each model.

B. Flood Prediction Using Machine Learning

This Paper published in 2018 by Amir Mosavi, Pinar Ozturk and Kwok-wing Chau. This paper introduces the most promising prediction methods for both long-term and short-term floods. Among them, ANN's, SVM and model optimization are reported the most effective strategy in improvement of the ML methods.

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C. Flood Prediction and Prevention through Wireless Sensor Networking

This paper was published in 2017 by Indira Priyadarshini. This paper have employed Wireless Sensor Networking (WSN) technology for predicting and preventing the flooding condition.The system collects data as images from the CMOS image sensors through wireless sensor nodes which transmit these images to remote monitoring center and provides early warnings to areas likely to be ravaged by flood events using WSN.

D. Early Flood Detection and Monitoring System based on WSN

This paper was published in the year 2018 by Uyioghosa B, Francis E, Idachaba and Segun I. This paper focuses on providing early warnings to areas likely to be ravaged by flood events using WSN. WSN is preferred due to its cost effectiveness and accurate computation of required parameter for flood prediction and prevention. The system involves the deployment of sensor nodes at specific flood vulnerable locations for real-time flood monitoring and detection.

V. DRAWBACKS OF THE EXISTING SYSTEM

Most existing systems are not efficient and are expensive to build and maintain. The existing systems has either human detection in floods or flood detection through rainfall flow consideration. No prior intimation about the flood. Hence, Inability to produce highly accurate results, If there is no sufficient data flood prediction cannot be done. Limited knowledge of using the emergency website for flood warning and updates might cause huge property loss.

VI. METHODOLOGY

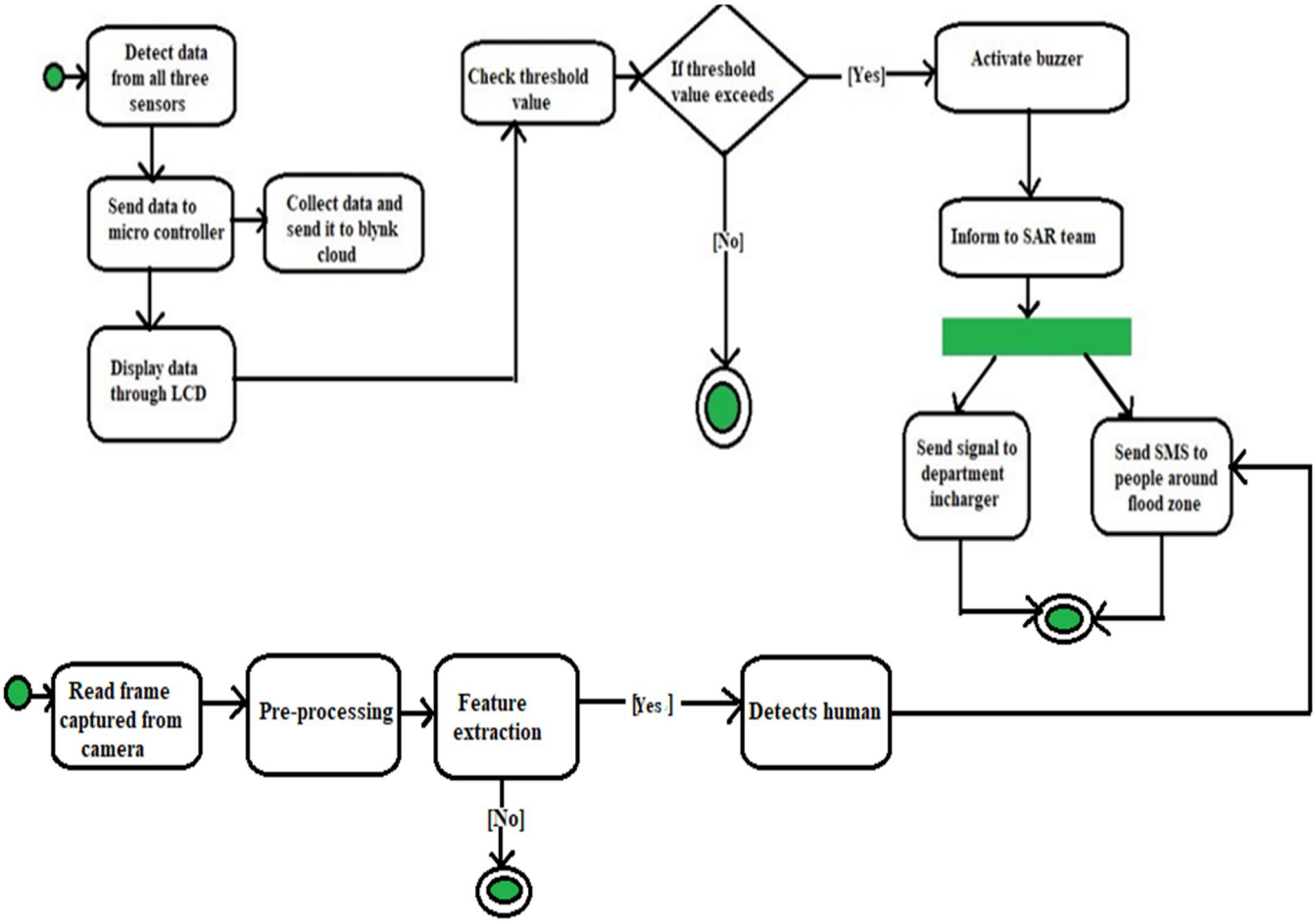


Figure 2: Activity Diagram for Flood Prediction and Victim Detection

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A. Flood Detection System

The first step is to collect the data from the sensors (ultrasonic sensor, flow sensor, rain sensor) and sends the data to the Arduino Uno microcontroller. Arduino Uno updates the data in the Blynk application through Node-MCU microcontroller which has inbuilt Wi-Fi feature. Arduino Uno will analyze the collected sensed data to compute threshold value to check threshold value is exceeded or not. If the threshold value is not exceeded process will be terminated and the values will be displayed on the LCD screen and in Blynk application which indicates that floods will not occur. If the threshold value is exceeded the limit of water level in the dams, rivers etc. immediately buzzers will be activated simultaneously, alerts the people around the flood zone so that they can save their lives and some valuable things. The same will be sent to Search and Rescue team (SAR) through Blynk application. All the values are displayed in the LCD screen. Search and Rescue squad can take necessary actions to rescue people in the flood zone and protect their lives from huge damage.

B. Human Detection System

1) *Image Capture and Preprocessing:* A CNN (convolutional neural network) is a artificial neural network based algorithm. Our system uses CNN as a main algorithm to implicit and identify the victim who are stuck in the flood. When a new image is used for CNN to identify the victim, the algorithm will classify the image and looks at the stored and trained image in the dataset and compare it and according to that it will predict and identify the object or victim. The first step is to train the model to detect only humans and animals. This is done using a Coco dataset and Yolo algorithm. Once the model a live victim images is captured, this is done with the help of web camera placed in flood zone. The captured images is then sent to a computer system for image preprocessing. The image processed using CNN. The image is converted to grayscale followed by background subtraction using Gaussian blur filter. Victims are detected using Blobs. The detected victims are counted and considered as frames. If the features of human is detected it prints as Human Detected and SAR team gets the intimation to rescue via Twilio account.

VII. RESULTS

A. Flood Detection

The water level sensor(ultrasonic sensor) which is used in this system detect the level of water or if it is nearby or far. The water distance is set by the user as he wish. As the water rises and reaches the highest Level of which is also known as the danger level it works to send the message through IOT based system. Water flow sensor detects and measure the flow of water. This sensor is immersed in water, on the flow of water the water flow rate will be measured. And the rain sensor module detects the density of rainfall. As a result of the final consequence. In the Flood Prediction after the threshold value of sensor is reached then an intimation is sent through Wi-Fi about the occurrence of flood in the specified locality and intimation will send to the rescue squad.

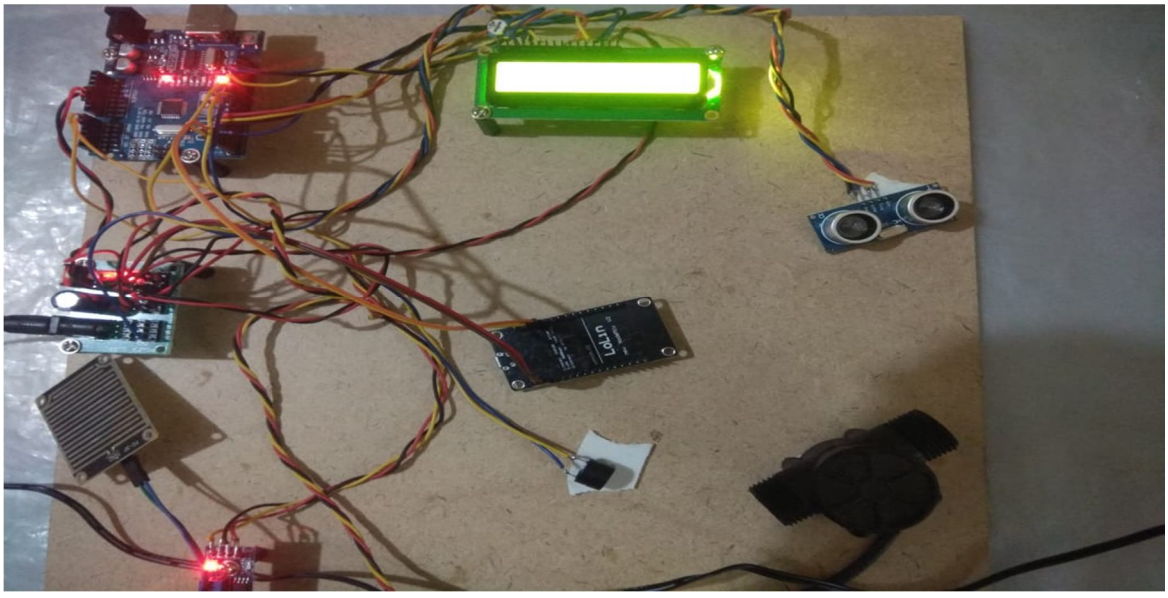
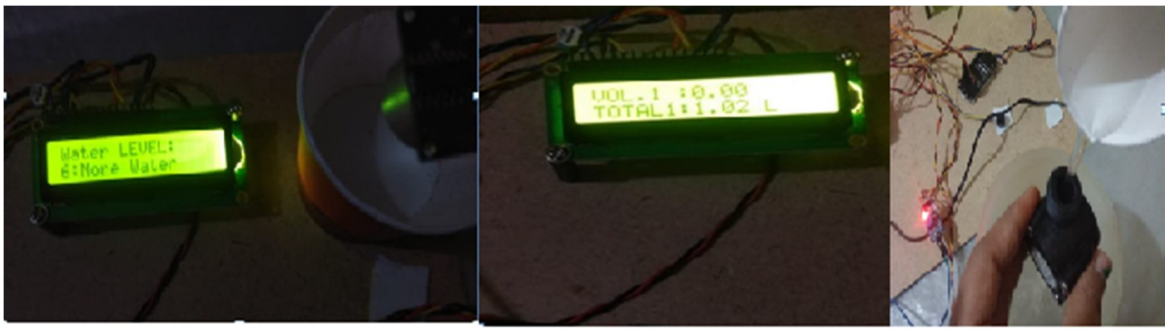


Figure 3 : Hardware Components

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Water level sensor

Flow sensor with flow rate



Rainfall Sensor with rain level Iindication

Figure 4 : Result from different Sensors

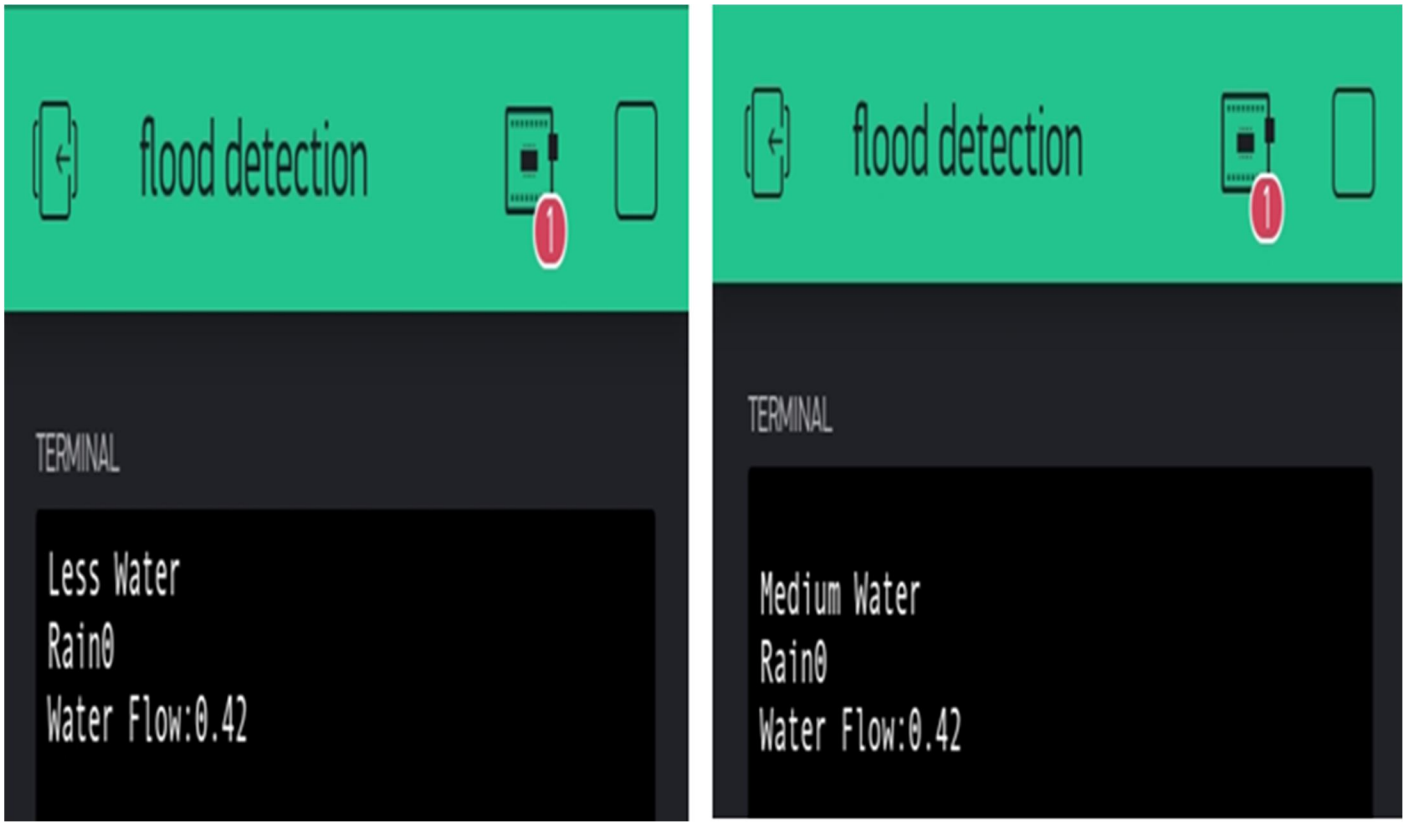


Figure 5: intimation in the Blynk app to the rescue team

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B. Victim Detection caught in disaster area

Victims caught in the flood zone captured by the camera and identified using YOLO and CNN. The live images and trained images both are compared and processed to check whether any victims are caught in that specified area and the identification will be sent to the SAR team(Search and Rescue).

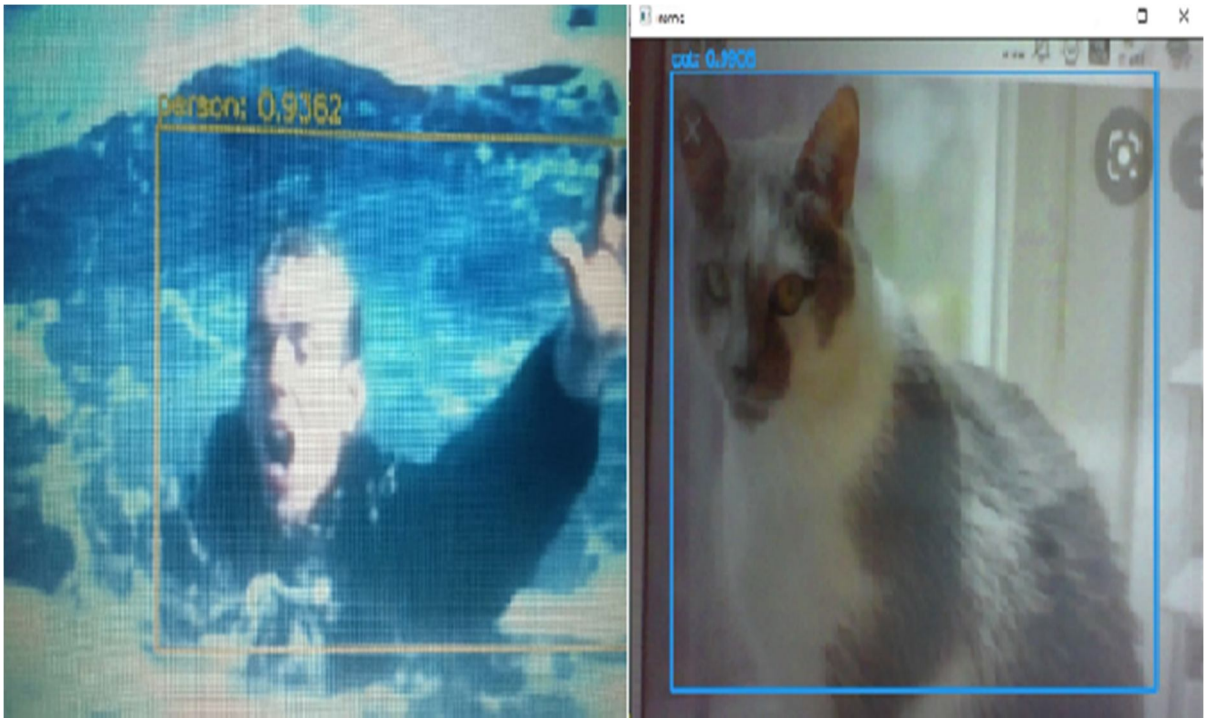


Figure 6: Victim Detection

VIII. FUTURE SCOPE

The proposed system can be further enhanced by integrating several sensors such as pressure sensor in order to accurate detection and cluster method can be used to analyze the water level of a different river segments for the improvements of water level prediction as well as the utilization of other deep learning algorithms for future regression of flood data.

IX. CONCLUSION

Floods are among the most devastating experience throughout the world. Their cost to the global economy is significant and continuously increasing and cause the risk for human and animal lives. To reduce flood impacts, early flood and victim detection have been implemented. This paper presents an overview of IOT and machine learning models used in flood prediction and victim detection which develops a classification scheme to analyze the existing literature. By use of Wireless Sensor Network any mechanical or geo-physical sensor can be interfaced easily for protection of our on livelihood as well as nation's wealth. This paper discussed a proto-model of NODE design for 'Flood Early Warning' which of great importance especially in heavy rainfall and hilly areas. The IoT-based early detection of the flood helps to save many lives and enables real-time updates about water level to nearby people so they can relocate to safe places with their valuables. The detection helps to prevent damage of houses and businesses due to floods. This project will also aims at detecting the victims in the Disaster affected areas by using CNN (Convolution Neural Network).The predicted result came out to be more accurate and finally the predicted result will be sent to the SAR(Search and Rescue) team.

X. ACKNOWLEDGMENT

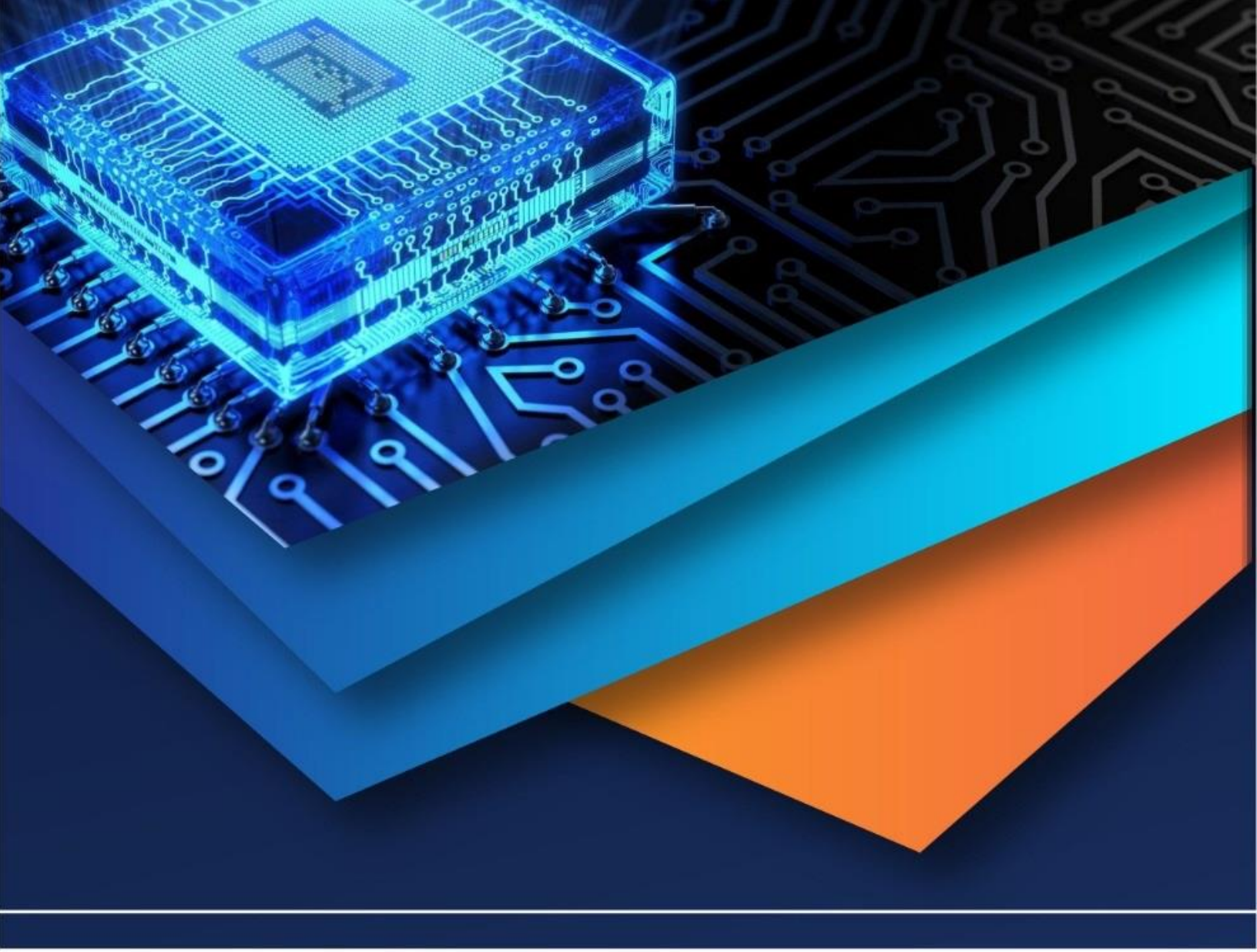
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