

FLOOD MONITOR AND DETECTING SYSTEM USING IOT AND IDENTIFICATION OF VICTIM USING IMAGE PROCESSING.

Keerthan B¹, Kiran S², Rakshith V R³, Kiran C⁴, Chaitra H K⁵

^{1,2,3,4}UG Student, Department of Computer Science and Engineering,

⁵Assistant Professor, Department of Computer Science and Engineering,

¹⁻⁵SJB Institute of Technology, Bengaluru, India-560060

Abstract - Flood is one of the disasters occurs naturally which cannot be avoided totally. Because of absence of early warning, every year, death rate increases due to flood. To solve this problem, this project illustrates the ideas and implementation of a Flood detection and Alerting system using Internet of Things (IOT) technology. If in case flood occurs, then we have implemented a victim detection module which detects the people who are struck in floods by using the Machine Learning concepts. In this project we use 3 types of sensors that is water flow sensor, water level sensor and rain fall sensor to detect the flood in early stages. We make use of convolution neural network to detect the victims who are struck in flood. The accuracy rate will be more by using this approach. Various images and videos are used to build the model and helps in identification of victim. So it will help the search and rescue team (SAR) to rescue the people who are struck in flood.

Key Words: Internet of Things, Image Processing, Flood Detection, Victim Identification, Convolution Neural Network, Real-Time Images.

1. INTRODUCTION

There are areas that are more defenseless against flooding. The usage and implementation of flood Detection systems near the areas where there is water logging provides important information of occurrences of flood at early stages so as to protect property and save lives. The best flood recognition techniques are expensive and require high maintenance to operate it. At present, there is no framework or data about when flood will happen so that one can safeguard the people who are in flood areas. Hence, we design this model to inform the people about the upcoming flood through notification and alert messages. For flood detection module we make use of three sensors which will be helpful to get information about the occurrence of flood at early stages and provide a safe place near the user location where user can relocate.

The system that is built provides accurate result to organizations, communities or individuals who are interested in establishing and controlling flood monitoring and 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.

The system built mainly contains three parts. The first part includes the sensor that measures the level of the water using water level sensor. The second part includes the sensor called water flow sensor that detects the flow of water. The third part is detecting rain fall using rainfall sensor and send information to residences to alert them about the probability of occurrence of flood through IOT. Natural disasters are unexpected events. Natural disasters can lead to huge losses of assets and objects and can even take lives of people. So, the most rapid and relevant disaster evacuation is needed so that victims of natural disasters can be identified and can be immediately evacuated and rescued, but evacuation process is filled with lots of obstacles and hurdles, such as disconnection of telecommunications networks and poor climatic and weather conditions. difficulty in reaching the 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 the problems mentioned above, this research project work is designed so that the SAR team can find out the victims of natural disasters quickly and more efficiently and inform the SAR teams in the evacuation process using the assistance of an unmanned aircraft (UAV) that can be controlled by the pilot or without control (autopilot). This detection makes use of branch of computer science that allows a system to detect required objects. This branch of computer science is called artificial intelligence with improvements in the field of image processing, and here processing is the object detection that is implemented on a minicomputer that can detect the presence of particular objects. Object detection is used to detect victims struck in natural disasters with predefined and pre-loaded objects that is overall pattern of the human body. CNN is a machine learning algorithm that comes under supervised learning. It contains the algorithms such as single layer perceptron neural network and multi-layer perceptron neural network. CNN algorithm is basically used by many people because of its higher accuracy rates and high performance. We provide the raw image or picture as an input and CNN will extract the

features automatically. The performance and accuracy of CNN can be improved drastically by tuning the inputs and weights of CNN. Just like ANN, CNN has many inner layers to process the pixel of the image. CNN has three main layers such as Convolution Layer, Pooling Layer, and Fully-Connected Layer. By making use of the CNN (Convolution Neural Network) method, it can easily recognize disaster victims that have been detected and adapted to existing training data. Excluding CNN, there are several different Artificial Intelligence algorithms that can help solve human problems.

Utilizing AI algorithm, system can carry out human activities such as recognizing objects, understanding a human conversation, and recognizing human writing. Flood basically occurs when there is an overflow of water from the dams, lake, rivers and heavy rainfall. It is not predictable and thus it can happen at any time of the year. Flooding is a very dangerous and hazardous problem. When floods occur in an area where people reside then water carries things like waste, garbage, furniture and sometimes even people along with flood water. Flood has ability to sweep farms, trees and lots of variety of property. For years, flooded roads have been a problem in Metro Politian areas. It causes heavy flow of traffic. People are getting stuck in a flooded area and getting lost in finding possible routes to go to their respective homes or destinations. When traffic occurs then people's money, time and efforts are wasted to a greater extent.

Making use of flood detection system the government has been improving instantaneously putting forward the efforts to inform regarding the situation in flood effected areas especially during rainy seasons. Still there is lack of information to the locals or people. This is the reason for building "Flood Detector System" module with high efficiency rates to help the people know the flood occurring probability. It was designed based on problem faced by people when flood occurred. This in turn will avoid property damage because the users will have enough time to find a possible route to avoid being stuck at the flood area. The system works when the user activates the system and when water along the river or dam is detected by distance over three sensors used. When the flood occur, the sensors will sent signal to the microprocessor circuit that is Arduino and detected water level will be display in the user interface such as LCD and it will automatically send a Short Message Service (SMS) to those recognized flood effected areas people and it will continue updating until the water level is normal. The process repeats as the water level continuous to increase. The idea of an SMS warning system was introduced cause of majority use of mobile phones or smart phones.

In developed country like United states, Japan etc. the flood problem is reduced significantly and does not affect much due to emergency system. But the developing countries like India, Brazil suffers a lot at times of flood. Every year death rates keep on increasing due to floods in different parts of

our country. Two years ago, the flood occurred in Chennai, which is in state of Tamil Nadu and resulted a huge loss of lives and property. Whenever, flooding happens living area near the riverbank and downstream area are affected severely than others. They need to be alerted much earlier to avoid this situation we need to have a Detecting warning system to provides such information so that people can avoid floods and false news.

2. LITERATURE REVIEW

Three components used in this system, which is composed of sensor detecting values, networking which sends sensors value, processing the sensors value which is sent by the network and transmitting of the values to the user or the operator. The water level condition is monitored as well as monitoring the rain intensity. In this we are using GPRS as a communication of sensors and sending the values to web-applications like Back-end which in turn is updated in front-end for user or the operators to see [1].

This uses the Machine Learning to Detect flood which occurs on road and other places. The ultrasonic which is used to detect flood is not a sufficient values to accurately find the flooded areas so this system uses infrared sensors which can detect flood because of thermal heat effects which are not accurately described in values using the ultrasonic sensors. This Infrared sensor which can sense ground temperature and variations in temperature is used in machine learning and is able to detect the floods [2].

Floods are a major problem which can occur in any parts if the water level rises to an unusual level. This happens when there is a high amount of storm or rain of water level in rivers or downstream areas which water can easily flow. To avoid and detect these kinds of flood and problems this system uses various sensors by the use of IOT [Internet Of Things]. Most sensors use IOT for wireless access and working of it and this is one of those system which uses IOT in order to detect floods earlier or prior to flood occurrence and can even monitor floods [3].

This system is a forecasting approaches of detecting flood using computational intelligence is proven to be one of the efficient methods. This system uses previous occurred flood and sees the rain fall intensity, water level of those flood and prior to those floods and area of floods and by using the ANN it statistical predict the next flood which is going to occur in which state or matter [high flood state or low flood state] and the parameters that are computed is taken in the form of error report which shows the accuracy of the flood prediction like mean absolute error, root mean square error, and coefficient of the result [4].

3. IMPLEMENTATION AND ANALYSIS

The system architecture contains an Arduino, power supply, Wi fi ESP module and sensors. We used three sensors in this architecture they are rainfall sensor, water level sensor, and water flow sensor. Arduino is the main base station every device is connected and linked to each other. Power supply will provide the electric power for working of sensors normally. The results are updated for every time with the message alerts and also displayed on the liquid crystal display (LCD).

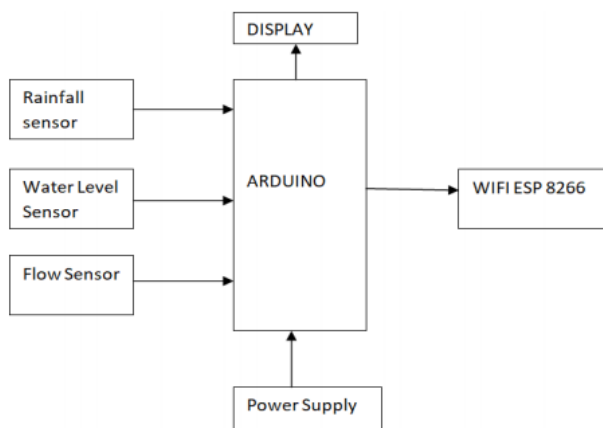


Fig – 1: System Architecture

3.1 Water Flow Sensor

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. This sensor has three wires they are red, black and yellow. This sensor mainly works on the hall effect. There is a production of electric pulses which will be raised on each turn or revolution. This sensor will be safe and dry due to electric effect. Pressure applied by the water also taken by this sensor and calculates the flow rate more precisely.



Fig -2: Water Flow Sensor

3.2 RAIN SENSOR MODULE

The rain sensor module detects the rain. It consists of a panel and wires. When rain drops falls on the panel it gives a

message that the rain detected. It acts like a switch that is when there is a rain drop falls on panel it will detect rain otherwise it does not give any message. Before using this sensor, we have to clear the water content on the panel.



Fig – 3: Rain Fall Sensor

3.3 WATER LEVEL MODULE

The water level sensor which is used in this system detect the water or if it is nearby or far. The water distance is set by the user and as an example if water is less than 20 mts away they water level is high, if water is 50 mts away then water level is medium, if water is 100 mts away then water level is high. 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.



Fig - 4: Water level Sensor

3.4 CNN ALGORITHM

A convolutional neural network (CNN) is a artificial neural networking based algorithm. Our system uses CNN as a main algorithm to implicit and identify the victim who are stuck in the flood. CNN works with image storing in a RGB type ad shown in Fig – 5 what human eyes see as a combination of colors appear to be a elephant the CNN algorithm converts it as a numbered RGB format and stores the image in dataset. When a new image is used for CNN to identify, 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. So the more image we train the more image it will be able to classify and predict more accurately. In our system we use CNN and YOLO together because CNN trains the algorithm but cannot identify the image which we want it to detect so YOLO which does the job in taking the CNN dataset and comparing it with new image as shown in Fig - 6 which we want to identify.

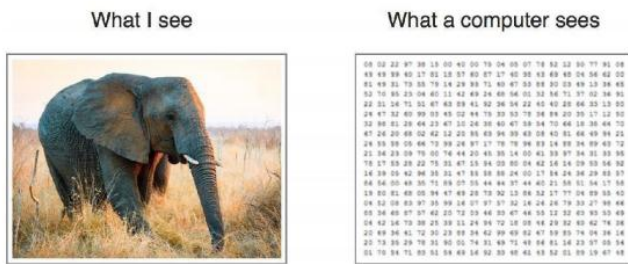


Fig - 5: CNN Image Classification

3.5 YOLO

YOLO (You Only Look Once) is the method or a platform used to do object detection/image detection aka victim identification. It is the algorithm where the dataset is trained by the image. by looking at different kind of the image and different kind of situation image scales and resized image classification technique to identify objects and store it as a dataset. This approach is fast and efficient which is why YOLO takes an entirely different opinion, yolo which looks at the entire image only once then goes through the network once and detects victim/objects. Hence the name YOLO. That's the reason why it is so popular.

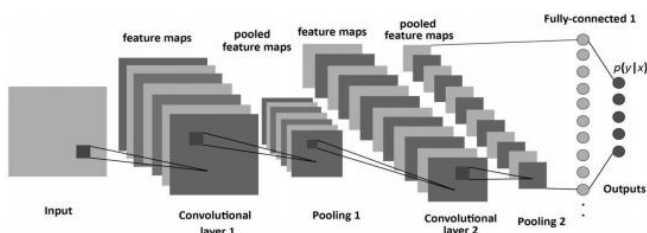


Fig - 6: Yolo Architecture

3.6 ARDUINO

Arduino Board is a microprocessor which acts as a platform in our system, Arduino helps us in connecting all the sensors together with a display and connect it to a Wi-Fi module Fig - 8 which helps us to get the result from the sensors when a flood occurs.

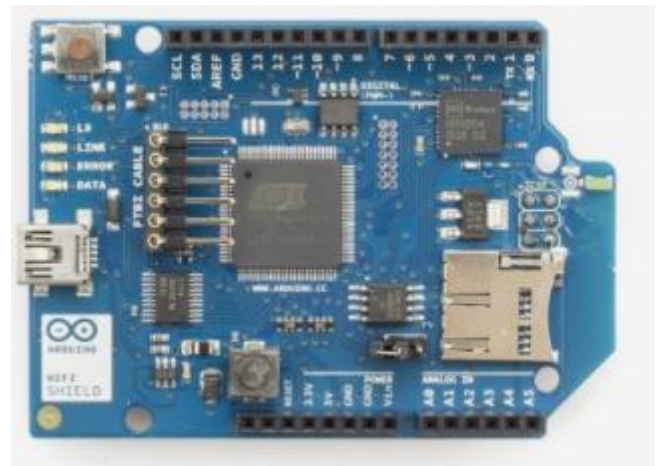


Fig - 7: Arduino Board

3.7 WIFI ESP 8266

Wi-Fi ESP 8266 is a network module which is connected to Arduino Board Fig - 7 which in turn connected to sensors. Wi-Fi ESP 8266 helps in passing the values or result from the sensors and pass it on to a platform like message or email.

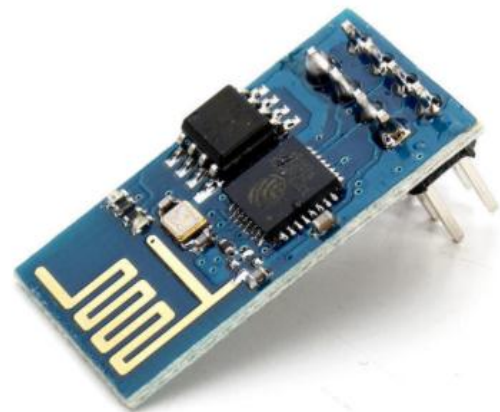


Fig - 8: Wi-Fi ESP 8266 Module

3.8 DISPLAY

A liquid crystal display [LCD] is used in our system in order to show the values of the sensor. LCD is connected to the Arduino board Fig - 7 directly which in turn connected to the 3 sensors and power supply, when the sensor detects value the Wi-fi module will send values via text message and to display immediately the [LCD] is used as shown in Fig - 10.



Fig – 9: Liquid Crystal Display



Fig -11: Victim Detection 1

4. RESULT

A result is the final consequence of actions or events expressed qualitatively or quantitatively. Performance analysis is an operational analysis. 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 so that life's and assets of people are saved. In the Disaster Victim Detection module, the drone images and footages are processed to check whether any victims are caught in that specified area.



Fig -12: Victim Detection 2



Fig – 10: Flood Detection Display Result

5. CONCLUSION

It is impossible to predict how and when the Natural Disasters occur. But it is possible to predict the floods that can be caused due to overflow in dams. The cause of flood Disasters depend on various factor ex: Water level in water bodies, Rainfall, water flow from dams etc. In this project we have considered the water level in dams by installing various sensors, we get water level so that continuous monitoring is done, if the threshold value of sensor gets exceeded an intimation about the flood is sent. Rainfall sensor and water flow sensor is also implemented and fixed threshold is kept, if the values of sensors crosses this threshold a notification on display , and a message in telegram along with beep of buzzer occur so as to know whether there is possibility of flood. This project also aims at identifying the victims in the Disaster affected areas by using CNN (Convolution Neural Network) which is a part of ANN (Artificial Neural Network). The predicted result came out to be more accurate.

REFERENCES

- [1] E. Basha, et al "Design of early warning flood detection system for developing countries," in Proc. of the Conference on Information and Communication Technology and Development, Dec 2007.
- [2] Mustafa Mousa, Christian Claudel, "Poster Abstract: Water Level Estimation in Urban Ultrasonic/Passive Infrared Flash Flood Sensor Networks Using Supervised Learning", IEEE2014
- [3] V. Krzhizhanovskaya, et al, "Flood early warning system: design, implementation and computational models," Procedia Computers Science, vol. 4, pp.106115, 2011.
- [4] M. Oprea, et al, "A microcontroller-based intelligent system for real time flood alerting,"
- [5] The Annual Mekong Flood Report 2010, viewed on 1st Nov 2011, viewed on 12Nov 2011,
- [6] Cholatip Yawut+ and Sathapath Kilaso, "A Wireless Sensor Network for Weather and Disaster Alarm Systems", 2011 International Conference on Information and Electronics Engineering IPCSIT vol.6 (2011) © (2011) IACSIT Press, Singapore.
- [7] "Flood Risk Management and Mitigation in Mekong River Basin", 8th Annual Mekong Flood Forum 2010, viewed on 12 Nov 2011.

BIOGRAPHIES

KEERTHAN B (1JB16CS067) is currently pursuing the bachelor's degree in Computer Science and Engineering, SJB Institute of Technology, Bengaluru, India. His research interest in IOT, AI and Machine Learning.



KIRAN S (1JB16CS071) is currently pursuing the bachelor's degree in Computer Science and Engineering, SJB Institute of Technology, Bengaluru, India. His research interest in Big Data Analytics and Machine Learning.



RAKSHITH V R(1JB16CS124) is currently pursuing the bachelor's degree in Computer Science and Engineering, SJB Institute of Technology, Bengaluru, India. His research interest in Machine Learning and Web Technologies.



KIRAN C (1JB16CS070) is currently pursuing the bachelor's degree in Computer Science and Engineering, SJB Institute of Technology, Bengaluru, India. His research interest in Python and Networking.



Chaitra H.K is working as Assistant Professor in the Department of Computer Science and Engineering at SJB Institute of Technology, Bengaluru, India. Pursuing Ph.D. Degree in the Department of Computer Science and Engineering, Research center at Bangalore Institute of Technology, under VTU, Belagavi, India. She is a life member of ISTE. Her research interest is in Data Mining, Web Mining, Big Data Analytics and Data Science.