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Unmanned Aerial Vehicle Assistance in A Catastrophic Event (UAV)

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ABSTRACT:

The fast development of unmanned aircraft (UAVs) and their application in a variety of fields has ushered in a new era of UAV use in disaster management. In UAV-assisted disaster response applications, UAVs aid in the development of a cumulative process between catastrophe survivors, rescue personnel, and the nearest available cell network. This study identifies the primary disaster management applications of UAV networks and discusses outstanding research challenges connected to UAV-assisted disaster management.

KEYWORDS: Accessible, Rapid, Survivors, Ushered.

I. INTRODUCTION

Natural catastrophes on a massive scale put a most fundamental human fear response to the test by inflicting massive and often unanticipated destruction on people or property. Natural catastrophes of several types, including geophysical (quake, wave, volcano), hydrologic (flash flood, debris stream, floods), and meteorological (flash flooding, debris flow, droughts) (extreme temperatures, droughts, wildfires), & climatological (tropical storms, hurricanes, sandstorms). A huge number of individuals have died as a result of heavy rainfall [1-5]. Acknowledging the need to improve catastrophe resilience, this study proposes a vision for merging the latest breakthroughs in Wireless Sensor Network (WSN) technology with Unmanned Aerial Vehicles (UAVs), with the goal of increasing the capacity of internet diversion [6]. Unmanned Aerial Vehicles (UAVs) are used for evaluation and reaction (UAVs). Natural catastrophes are a major problem in all parts of the world, both developed and developing [7]. The issue emerges from the disaster's physical scope. As a result, humans are unable to comprehend it [8]. Efforts are currently underway to recognise and resolve this problem. Efforts include foreseeing the likelihood of a catastrophe and reacting on time [9]. It also provides an effective response to the catastrophe that is currently occurring, and to assess, repair, and restore the damage in a timely and productive manner according to the standard situation. In this article, we address open problems and research challenges related to UAV-assisted disaster management systems [10-15].

II. LITERATURE SUTDY

1. Moving Object Detection and Tracking Using Convolutional Neural Networks by Prof. Supriya Mangale and Shraddha Mane [2018].

This project incorporates previous work on object ground truth detection, context subtraction, segment, and classification techniques. The features that describe the object are most critical for perfect tracking, so object identification is crucial. This can be accomplished by the use of deterministic or probabilistic motion models, as well as appearance-based models. Modifications to the models have been provided over time in order to improve its correctness. The data points were educated and modified during the tracking process. The only problem with monitoring an item is that it requires a range of characteristics that aren't always accessible.

Drone Based Disaster Management System by Atul Panmand, Omkar Sawant, Kunal Pange, Rahul Nikam [2019]

This article focuses on drone-based technology. The system's overall operation is controlled by a controller and a microcontroller in this model. According to calculations, it is implemented and planned for a range of 450mm with a 1000kV BLDC motor. Sensors such as the IR sensor and the GAS sensor are used in disasters and communicate with the microcontroller. As a result of this application, smart drone technology is developed. This device uses a camera to transmit live video, which saves money. In the absence of a human, this machine senses the obstacle and causes the motors to spin at the same speed to prevent crashing.

2. Maher Aljehani and Masahiro Inoue [2016] Multi-UAV Tracking and Scanning Systems in M2M Communication for Disaster Response

This study utilized multi-UAV as network devices in the M2M communication system to monitor and deliver visual data from the affected areas. Because it is unaffected by calamities, the UAV has proven its reliability as a reliable M2M device. Tracking UAVs tracked people in this investigation, while Scanning UAVs scanned the surroundings. The success of the tracking process is determined by the capabilities of the UAVs and their location. After just a crisis, refugees will be given alternate routes or coloured evaluated maps based on real-time analysis of afflicted areas. The data delivery timing in this system is determined by the track and scan speeds of the UAV.

Object Detection Algorithms for Video Surveillance Applications by Apoorva Raghunandan, Mohana, Pakala Raghav, and H. V. Ravish Aradhya [2018]

MATLAB 2017b is used to model a variety of item detection techniques, including skin detection, colour detection, image recognition, & target tracking, with an accuracy of roughly 95%. Variables like detection precision and RGB Euclidian Cutoff in Detection Systems can improve the overall performance of video surveillance systems. Skin Recognition and Simulation have both been tested and implemented. Furthermore, to meet video surveillance uses that aid in the identification of persons trapped in disasters, a single algorithm might be constructed by taking into account multiple extracted features such as colour, face, skin, and the subject of interest..

3. **Object Detection and Count of Objects in Image using Tensor Flow Object Detection API by B N Krishna Sai and Sasikala T [2019]**

In this paper, we examine at a model that detects dangerous items in photos using Faster R-CNN. The model constructs it using the Object Detection API. The classifier was tested for roughly 4500 steps in order to obtain a loss of less than 0.1, which took 12 hours, and it was then tested using test photos, which revealed that it performs by always producing superior results. It shows its research development, which includes training a huge number of photos and learning the model with a larger sequence of iterations for better results.

ABBREVIATIONS AND ACRONYMS

M2M: Machine to Machine

RGB: Red Green Blue

API: Application Program Interface

R-CNN: **Region-Based Convolutional Neural Networks**

III. METHODOLOGY

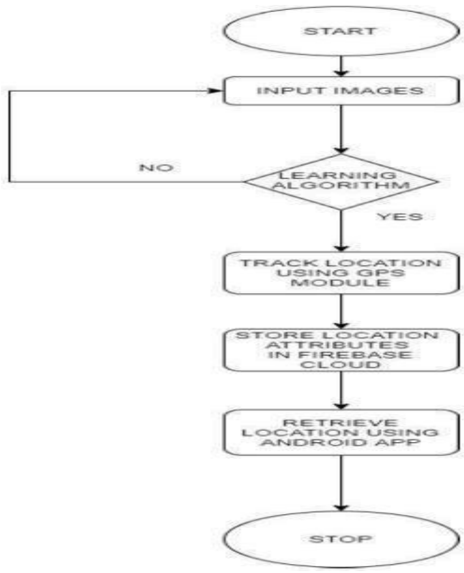

Figure 1: Methodology Flowchart

Object detection is a machine vision and image processing technique that uses deep learning convolution neural networks to detect semantic artefacts of a specific class in digital images and videos. In Deep Learning, the Convolution Neural Network is one of the most commonly used artificial neural networks. It's commonly used to train models with image inputs. CNN's are part of the Feed Forward Neural Networks class [16-20]. The input to the Convolution Neural Network is arrays of pixel values. Now, using convolution neural networks, the trained model will detect a real-time object as an individual, and the position of that human will be tracked using a Neo 6m GPS module connected to a Raspberry Pi.The monitored human position is now stored in a database (firebase real-time database), and the location attributes can be provided to rescue committees such as the NDRF. This is provided by an app (developed using android studios) that can retrieve the location attributes stored in the firebase realtime database [21-27].

IV. IMPLEMENTATION

1. CONVOLUTIONAL NEURALNETWORKS

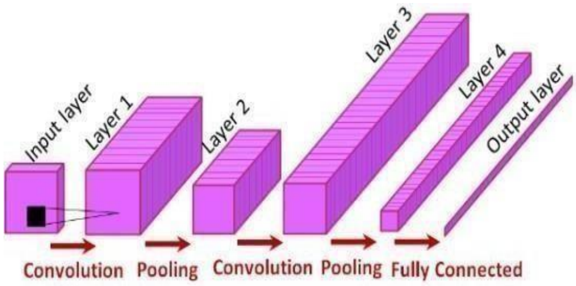

Figure2: The CNN Architecture including the Convolutional, Pooling and Fully Connected Layers

The Convolutional Neural Network (CNN) is a deep learning technology biologically inspired phenomena. It consists of hidden layers of small neuron groupings which look on small portions of the input neurons, known as receptive fields. CNN contains three layers, as shown in Figure 2: input, hidden layers, and output. The output unit is an array of highly identifiable CNN elements with a set duration, An theory make with configurable dimensions is used as the input layer. Hidden layers include convolution layer, sample layer (pooling layers), and totally linked layers [28-33]. The convolution layer is made up of various filters that have been automatically applied to the localized regions of the input image to extract information. The sampling layers is indeed a non-linear straight function, similar to maximum pooling, that lowers the temporal size of the input layer with time. The channel's output layer with maximum health is the entirely linked layer, for each cell linked to exactly several of the preceding feature maps [34-37].

2. GENERAL FRAMEWORK FOR OBJECT DETECTION

Figure 3: Image Spanning

A deep learning model or algorithm is first used to produce a large number of bounding boxes that span the entire image (that is, an object localization component) [38-39].

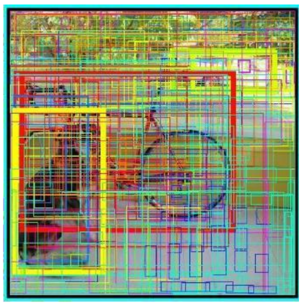

Figure4:Feature Extraction

Following that, visual features for each of the bounding boxes are extracted. Based on visual characteristics, they are evaluated and it is determined if and which items are present in the boxes (i.e. an object classification component) Overlapping boxes are merged into a single bounding box in the final post-processing stage [40].

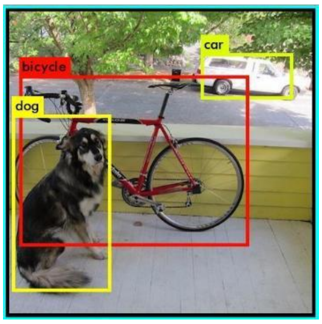

Figure5: Final Post-Processing.

V. RESULTS

The pi Camera will first identify and capture the image of humans trapped in the disaster during the object detection process. Humans are used as an entity in this scene. The Object Detection algorithm determines whether the captured image is of a human or another object and assigns a score to it.

Figure 6: Object Detection API Output

The Raspberry Pi will classify, whether the detected image is of human or other objects. Ifthe obtained image is of humans, then Raspberry pi sends a command to GPS Module to read thelocationofLatitude andLongitude. TheGPSModuleafterdetectinglocationbyreadingLatitudeandLongitude,Co-ordinatesare then uploaded to a database which is later retrieved by the Android application

VI. CONCLUSION

When using the project solution as a product, it is possible to detect and monitor humans stranded in any natural disaster-affected region from afar and take action based on the data. To prevent any mishaps or leaving someone out, the operator should warn the rescue or emergency, management team. The key goal in developing this product was to make it easier to track and control the rescue operation from afar. The tracking device can be easily controlled thanks to the user-friendly controller unit. The Raspberry Pi was chosen as the main development because it has a larger operating range and faster processing speed, which increases the operating speed to react to the operator. Since the correspondence is performed over the internet, there are no range limitations. Any computer that has been registered with the application can obtain the location.

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