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Survey: Search and Rescue Operation during Natural Calamities Using Unmanned Aerial Vehicle (UAV)

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Abstract— *Natural and Manmade calamities affecting various regions causes a lot of human casualties. Disasters are unstoppable and exceptional events such as earthquakes, wildfires, floods, terrorist attacks, etc. this lead to a massive death of people being stuck or no help received on time. The recent 2019 Kerala floods resulted into a life penalty of 101 people and seven went missing One of the main challenges faced by the search and rescue teams during a massive disastrous situation is the search of survivors and victims as early as possible and also reaching them to rescue. This system focuses on the implementation of human detection by using an unmanned aerial vehicle during disastrous conditions. This system helps in rescue operation by scanning affected area through optical and thermal cameras and detects humans. It will also provide actual location of humans via an android application. This system consists of sensor based monitoring system. As it is a drone based system, it can easily be controlled. Data communication is handled through LoRa technology which is a long range and power efficient technology. The system sends the data further to rescue teams for taking actions and investigations. This system will prove helpful for search and rescue teams and serve the purpose in large calamitous conditions.*

Keywords— Embedded Domain System, Disaster Area Monitoring, Human Detection, Obstacle Detection, Geotagging and Location Storing, Android Application.

I. INTRODUCTION

Natural and Manmade calamities affecting various regions, causes a lot of human casualties. Disasters such as earthquakes, wildfires, floods, terrorist attacks, etc are unstoppable and leads to a massive death of people either because of people being stuck or no help received on time. The recent 2019 Maharashtra floods has resulted into a life penalty of 56 people. The objective is implementation of human detection by using an unmanned aerial vehicle during disastrous conditions. This system helps in rescue operation by scanning affected area through optical and thermal cameras and detect humans. It will also provide actual location of humans via an android application. This system consists of sensor based monitoring system. As it is a drone based system, it can easily be controlled. The system sends the data further to rescue teams for taking actions and investigations. This system will prove helpful for search and rescue teams and serve the purpose in large calamitious conditions. The ultrasonic sensors are used to detect the obstacle coming in front of drone.If there is obstacle detected in front of the drone, then the direction of the drone changes. The wifi module is used to send the data of the location where the human is detected.

II. LITERATURE SURVEY

A.A.Rivera et.al.[1] focuses on the implementation of the human detection and geolocation system of the human using Unmanned Aerial Vehicle. The human detection is done by the thermal and optical Imagery. Geolocation was achieved using triangulated-adjusted GPS data and integration of Google Maps. The higher accuracy reflected by the thermal sensor at night time proved the thermal detection works best when used during night operations. The data implies

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that the optical detection works efficiently during day time. The results obtained by optical camera during day time are more accurate as compared to night time. The geolocation capability was measured by 10 meters detection radius.

S.Lee et.al.[2] focuses on human rescuers at the disaster sites. The drone has become an effective tool for searching survivors from confined space such as collapsed building or underground area. The infrared camera and LIDAR sensor are used in fusion. This paper tells that fusion of infrared camera and LIDAR sensors can assist rescuers to find victims of natural disaster in unknown environments, and the detection system is insensitive to illumination change. In this paper the infrared camera and the LIDAR sensors are used in fusion its becomes difficult to control the drone. GPS location is not used to give the location of the victim.

T.C.Mallick et.al.[3] proposed the development of unmanned aerial vehicle(UAV) which is controlled by wireless technology. This system proposed in this paper is capable to fly in different mode without complexity. It's performance, movement, orientation, motion, balance also good. This machine have facility to peer flight statistics with the aid of using powerful floor station and consumer can upload or override a assignment in real time flight condition when a task running. The overall total weight of implemented design is 1.46kg and its carrying capacity is 0.5kg. The system proposed in this paper does not focuses on the obstacle faced by UAV while flying and also on the range of the drone.

R.Tariq et.al.[4] focuses on locating and finding survivors and victims in the disastrous situation like war, tornados or earthquakes. It is very difficult for rescue team to reach certain sensitive areas due to the immense amount of debris. The system has Passive Infrared Sensors (PIR) to detect radiations generated by human body. It will work efficiently in searching people trapped under the rubble and marking their locations as well as sending alerts, so that rescue teams can come in and aid those in need of assistance. The system gathers real time data day and night in challenging conditions and without any risk to personnel. In this paper, PIR (Passive Infrared Sensors) are used which works effectively in LOS (Line of Sight) and will have problems in the corner regions. The sensitivity of the sensor is very low. The PIR sensor sense heat signatures in the room.

M.Zacharie et.al. [5] focuses on the human detection using Image Processing. But despite all of the improvements in technologies, know-how of the mechanisms of nature and the damages brought about via natural disasters, which includes earthquakes, landslides, and flooding to mention handiest a few, are nonetheless very far away. In the attempt of saving lives all through natural disasters, including earthquakes, this have a look at introduces a rapid human frame detection using picture processing from UAV digital camera. The skin coloration from a female student is first extracted in RGB then transformed to HSV. Next, beginning and ultimate morphological operations are done eight times every to do away with all noise present in the photo. Experimental tests were carried out each indoor and outdoor, in which the lady student presented an object near and some distance to the digital camera to test the detection functionality in both cases.

The experiment results display that close or a ways, the digital camera can honestly detect both a human body and any a part of a human frame. The outcomes of the test prove the merit of the proposed metshod.

A.Rahmadhani et.al.[6] proposed development of long range and low power consuming unmanned aerial vehicle using LoRaWAN technology. Developing a long-range and energy- efficient communication system is the important topic proposed in the paper. LoRaWAN, a standard protocol for LoRa intended for wide area networking, can be used for drone delivery application. However, it is not suitable for real- time and control-heavy applications. In this paper, the limits of LoRaWAN as a secondary communication mode for drone delivery system are evaluated. The results show that LoRaWAN protocol can still be used for a semi- real-time telemetry purpose in which it can send 10-20 bytes payload regularly with minimum of 2-3 seconds interval. In terms of coverage, the system can achieve up to 8 km in an urban area as tested, using the lowest spreading factor, considering the imperfection factor from the hardware. The percentage of packet loss using this configuration is still tolerable, i.e., up to 5%. The LoRaWAN module used is SX1276 LoRa chipset and Arduino Uno flashed with LoRaWAN stack.

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V.A.Dambal et.Al.[7] LoRa technology permits long-range verbal exchange with low-power intake for the Internet-of-Things (IoT) devices inside the city and suburban environment. However, due to the fact of terrestrial structures in city and suburban environments, the hyperlink distance of LoRa transmissions can be reduced In this paper, we document signal power measurements for the in-building and inter-building LoRa hyperlinks and provide insights on factors that have an effect on signal first-rate which include the spreading factor and antenna orientation. Subsequently, we also provide measurement outcomes in city and suburban environments while the LoRa transmitter is deployed at exceptional heights the usage of an unmanned aerial vehicle (UAV). The findings display that the UAV deployment top is vital for enhancing coverage inside the suburban surroundings and antenna orientation affects the conversation range.

L.Chen et.al[8] air quality monitoring usually rely on statically deploying stationary monitors done by government. However, many air pollution emissions are irregular and uncertain. How to dynamically and effectively monitor air pollution emission will be an important issue for environmental protection. In this paper, we design a LoRa-based air quality monitor tied on Unmanned Aerial Vehicle. It can achieve two goals. The first is that the UAV can real-time send the sensed data back to server if it is flying to long-distance monitored target. The other is that the UAV can perform sensing task itself with minimal human intervention. They have implemented a prototype of LoRa-based air quality sensor on a UAV and a web-UI for user to configure the route of UAV and view the sensed data immediately. We believe that the prototype can be used easily to monitor the air quality with minimum human intervention.

T.Giitsidis et.Al.[9] illegal migration as well as wildfires constitute not unusual conditions in southern European countries, where the mountainous terrain and thick forests make the surveillance and region of these incidents a tall task. This territory could gain from Unmanned Aerial Vehicles (UAVs) ready with optical and thermal sensors along with sophisticated photograph processing and laptop imaginative and prescient algorithms, in an effort to come across suspicious pastime or save you the spreading of a fire. Taking into account that the flight height is about to two kilometers, human and fire detection algorithms are mainly based totally on blob detection. For both processes thermal imaging is used that allows you to enhance the accuracy of the algorithms, while in the case of human recognition statistics like motion patterns in addition to shadow length and form also are considered. For fire detection a blob detector is utilized at the side of a shade based totally descriptor, implemented to thermal and optical images, respectively. Unlike fireplace, human detection is a more worrying technique ensuing in a more sophisticated and complex algorithm. The main problem of human detection originates from the excessive flight altitude.

P.B.Parappat et.Al[10] says Unmanned Aerial Vehicles are increasingly more being used for army and civilian purposes. Obstacle avoidance is an important aspect for any mobile robot including UAVs. Indoor UAVs touring through a corridor can autonomously avoid obstacles and do direction planning with LIDARs. Outdoor UAVs can discover limitations using radars. This paper proposes a new algorithm to autonomously avoid boundaries using radars and picture processing of video frames to hit upon and avoid barriers. Typically, UAVs are limited by means of on- board computational and memory constraints. This new set of rules aims to lessen the computational requirement. The overall performance of this algorithm is compared with the brute force pixel-by way of-pixel comparison or the MLE algorithm.

G.Hristov et.Al.[11] says Forest fires are occurring at some stage in the 12 months with an increasing intensity in the summer time and autumn periods. These occasions are in particular caused by the actions of humans, but exceptional nature and environmental phenomena, like lightning moves or spontaneous combustion of dried leafs or sawdust, also can be credited for their occurrence. Regardless of the motives for the ignition of the wooded area fires, they usually cause devastating harm to each nature and humans. Forest fires also are considered as a primary contributor to the air pollution, due to the fact that during every fire big amounts of gases and particle mater are released inside the atmosphere. To combat wooded area fires, one-of-a-kind answers had been employed throughout the years. They ware number one aimed toward the early detection of the fires. The simplest of these answers is the status quo of a community of observation posts – both cheap and clean to accomplish, however additionally time-consuming for the worried people.

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M.F.Ramli et.Al[12] Achieving a sturdy impediment detection system for small UAV could be very challenging. Due to size and weight constraints, very constrained detection sensors can be equipped within the gadget. Prior works targeted on a unmarried sensing device that is either digicam or variety sensors primarily based. However, those sensors have their own blessings and drawbacks in detecting the look of the obstacles. In this paper, mixture of both sensors based is proposed for a small UAV impediment detection device. A small Lidar sensor is used as the preliminary detector and queue for photograph capturing through the camera. Next, SURF set of rules is implemented to find the obstacle sizes estimation with the aid of looking the connecting feature points within the image frame. Finally, safe avoidance route for UAV is determined through the exterior characteristic points from the estimated width of the obstacle. The proposed approach became evaluated by using undertaking experiments in real time with indoor environment.

III. ANALYSIS TABLE

Sr. No.	Title Of Paper	Technique Used	Limitations
1	Post-disaster Rescue Facility: Human Detection and Geolocation Using Aerial Drones.	The human detection is done by thermal and optical imagery.	The range of the drone is not sufficient.
2	Drone-Assisted Disaster Management: Finding Victims via Infrared Camera and Lidar Sensor Fusion.	The infrared camera and LIDAR sensors are used in fusion for human detection.	The controlling of drone is difficult due to fusion of sensors.
3	Design & Implementation of an UAV (Drone) with Flight Data Record	Quadcopter dynamics, Arduino APM module 2.8 etc these are some components and techniques used.	The system proposed in this paper does not focuses on the obstacle faced by UAV
4	DronAID:A Smart Human Detection Drone for Rescue.	PIR sensors are used for human detection.	PIR sensors are insensitive to slow motion object.
5	Rapid Human Body Detection in Disaster Sites using Image Processing from Unmanned Aerial Vehicle(UAV) Cameras	-Optical Cameras. -Human body detection using image processing from UAV	Optical sensors are not only sufficient for human detection .

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6	LoRaWAN as Secondary Telemetry Communication System for Drone Delivery	The LoRaWAN module used is SX1276 LoRa chipset and Arduino Uno flashed with LoRaWAN stack	-------
7	Improving LoRa Signal Coverage in Urban and Sub-Urban Environments with UAVs	Setup used is LoRa Tech Evaluation Kit–900 by Microchip Tech which has a bandwidth of 125 kHz and operating between 902 − 928 MHz.	------
8	A LoRa-based Air Quality Monitor on Unmanned Aerial Vehicle for Smart City	Raspberry Pi is triggered to get the reading of PM2.5 sensor and then send the reading to backend cloud server through LoRa module.	-------
9	Human and fire detection from high altitude UAV images	-Blob detector captures optical and thermal images -GPS positioning is provided by navigational portion of UAV	The fusion of optical and thermal images is more beneficial than a separate usage of each image.
10	Obstacle avoidance by unmanned aerial vehicles using image recognition techniques	Image recognition technique is used and radar sensors for obstacle detection.	Radar sensor will not change the direction of UAV only the obstacle will be detected.
11	Emerging methods for early detection of forest fires using unmanned aerial vehicles and LoRaWAN sensor networks	LoRaWAN sensors are used for forest fire detection, environmental sensing and the long term air-quality analysis.	-------
12	Obstacle Detection Technique Using Multi Sensor Integration for Small Unmanned Aerial Vehicle	A small Lidar sensors are used as the initial detector and queue for image capturing by camera.	If detected obstacle is greater, than the avoidance distance will be much higher, which will lead to more computational time.

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IV. CONCLUSION

This system is helpful for search and rescue teams to search human beings in less time and also keeping health of people into consideration. Our project hereby tries to solve problems faced by rescue team. This system consists of sensor based monitoring system. As it is a drone based system, it can easily be controlled. Data communication is handled through LoRa technology which is a long range and power efficient technology. The system sends the data further to rescue teams for taking actions and investigations. This system will prove helpful for search and rescue teams and serve the purpose in large calamitous conditions.

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