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A low cost fully autonomous GPS (Global Positioning System) based Quad copter for disaster management

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***Abstract*—With the advent of real life applications in the fields of public safety like disaster management and defence, Quad copter is becoming more and more popular. Quad copter does not require any traffic signal; it can fly in the sky like bird and it can go anywhere as per requirement. This feature has boosted up the popularity of Quad copter in the community. Now a day's more and more fields get dependent on Quad copter, therefore the system needs to be more robust and less expensive. For example, in defence field security is the major issue, while in Disaster management time public safety is the major issue. The paper proposes a low cost, secure (as it has Global Positioning System installed in it, so it can hold at any position getting proper instruction by operator) and autonomous model for a Quad copter. This quadcopter can be controlled manually via transmitter (minimum 4 channel).**

Keywords— Automation, Drone, Defence, Disaster Management, UAV, Quad Copter.

I. INTRODUCTION

At present time we all are trying to implement a concept called Man-Machine concept everywhere all over the world. This Quad copter is one of the examples of a man machine concept implementation. In real time when a Disaster happens due to earthquake, any construction collapsed or in time of flood, manpower of disaster management team reaches there and rescues the victims; But sometimes too many area where victims are there and they are alive but people from rescue team are not able to reach there. In this situation quad copter can help; like if Quad copter is flying at disaster area then through night vision it is possible to see how many people are stuck and where they stuck on and how many of them are alive. If anywhere suddenly conflagration happens, and then Quad copter can spray water or any fire resistant. As it has camera with live broadcasting system, it can easily show everything live and any rescue team of any disaster management team can take proper action. In time of flood, where rescue team is not able to reach, there Quad copter can go and can provide drinking water and proper food, so that they can survive.
The rest of the paper is organized as follows. Section 2 surveys the related work. Section 3 gives a brief overview of the proposed system. Section 4 states some of the notable issues regarding this technology. Section 5 explains the importance of the proposed methodology with respect to the present world scenario. Finally, Section 6 concludes the paper.

II. RELATED WORKS

For clarification, containment and combat of huge danger areas, quick and versatile survey of potentially contaminated areas is an emerging challenge. We have a tendency to gift a project that focuses on incidents that are caused by uncontrolled emissions of liquid or vaporous contaminants (e.g. explosive or toxic gases or liquids, biological, chemical or nuclear weapons). Rather than sending specially equipped forces with costly

transport and measuring devices into the contaminated space, our projected system makes use of an autonomous, wireless connected swarm of Mini Unmanned Aerial Vehicles (MUAV), often merely called drones, that area unit featured with light-weight mobile sensing element systems. We are going to be notably specializing in the advanced communication system, which on the one hand has got to organize the on-board-communication between the management systems of the MUAV and therefore the sensors and on the opposite hand has got to establish wireless connections to the mission control centre on the ground in addition on neighbouring MUAVs within the air via a mesh network. [1]

Resilient communication networks, which may continue operations even after a disaster, are a central feature of future smart cities. Recent proliferation of drones propelled by the supply of low cost commodity hardware presents a brand new avenue for provisioning such networks. Specifically, with the appearance of Google's Sky Bender and Facebook's net drone, drone sceptre tiny cellular networks (DSCNs) aren't any longer fantasy. DSCNs are engaging solution for public safety networks because of swift preparation capability and intrinsic network configurability. Whereas DSCNs have received some attention within the recent past, the planning area of such networks has not been extensively traversed. Specifically, co-existence of such networks with an operational ground cellular network during a post-disaster scenario has not been investigated. Moreover, style parameters like optimal altitude and range of drone base stations, etc., as a result of destroyed base stations, propagation conditions, etc., haven't been explored so as to deal with these style problems, we tend to gift a comprehensive statistical framework that is developed from random geometric perspective. We tend to then use the developed framework to analyse the impact of many constant quantity variations on the performance of the DSCNs. while not loss of any generality, during this article, the performance metric used is coverage probability of a down-link mobile user. It’s incontestable that by showing intelligence choosing the quantity of drones and their corresponding altitudes, ground users coverage is considerably increased. This can be earned while not acquisition vital performance penalty to the mobile users that still be served from in operation ground infrastructure. [2]

Many cities or towns are placed in mountain and ocean areas, and these areas would be isolated from others due to the disconnection of networks or transportation if an oversized scale disaster ought to happen. Delay Tolerant Networking (DTN) supported the data sorting technique with the user policies and also the Autonomous Flight Wireless Nodes (AFW) supported autonomous flights and data deliveries are introduced. Within the planned system, the drone with wireless interfaces is applied, and it actively supports the planned DTN routings for the Disaster system (DIS). That is, the AFW mechanically flies for seeking possible wireless nodes, send and receive disaster data by the planned DTN routings, and come to the possible stations that wireless charge units are equipped once the battery has to charge. Then, the implementations and the field experiments are mentioned for the effectiveness of the planned ways. [3]

In case of a large scale disaster, the wireless access network will become quickly saturated. This can be in fact undesirable because for this sort of things we really want a reliable wireless property. During this study, the potential of mounting LTE femtocell base stations on drones to supply an alternative for the saturated existing wireless infrastructure is investigated. Our preliminary results show that this a really promising approach though a high quantity of drones are required to cover all users within the centre of Ghent, Kingdom of Belgium throughout a 1h intervention. the quantity of drones may be considerably reduced (up to 64%) by employing a additional advanced variety of drone, by decreasing the user coverage demand (11% less drones when requiring 80th rather than 90%) or by increasing the fly height of the drones (about 100% less drones required when increasing the fly height by 10 m). This study shows that it's more interesting to investigate the utilization of drones to supply an emergency wireless access network. [4]

Advances in control engineering and material science made it possible to develop small-scale remote-controlled aerial vehicles (UAVs) equipped with cameras and sensors. These UAVs enable United States of America to get a bird's eye view of the surroundings. Having access to an aerial view over massive areas is useful in disaster things, wherever usually only incomplete and inconsistent data is offered to the rescue team. In such things, mobile cameras and sensors are valuable sources of data serving to United States of America to create an "overview" of the surroundings and to assess this state of affairs. During this "aerial device network" many UAVs fly in formations and get together to realize a precise mission. The ultimate goal is to possess an aerial imaging system in which UAVs build a flight formation, fly over a country like wood fire or a

large traffic accident, and deliver high-quality sensor data such as pictures or videos. These pictures and videos area unit communicated to the ground, fused, analysed in period, and at last delivered to the user. During this paper we have a tendency to introduce our aerial device network and its application in disaster things. We have a tendency to discuss challenges of such aerial device networks and specialize in the best placement of sensors. We have a tendency to formulate the coverage downside as integer linear program (ILP) and gift first analysis results [5].

Advanced knowledge analytics are the next frontier in investing drones for emergency response. One among the benefits of solution-focused algorithms is that the ability to use them across industries from emergency response applications to agriculture to energy, even distinguishing toxic industrial waste within the air in real-time.

In mid-February last year, Precision Hawk issued an emergency COA to conduct a survey over the Bennett Industrial lowland in Lockhart, South Carolina. Toxic particulates were being free into the air, as well as amphibole and alternative probably harmful chemicals, therefore it absolutely was crucial that the Environmental Protection Agency (EPA) assess the situation quickly. The EPA, however, couldn't get an correct volumetrically survey of the realm as a result of a vigorous fire affecting some sections of the landfills, and chemical exposures that made the scene unsafe for ground surveyors. To handle the case, PrecisionHawkflew a drone to form a 3D reconstruction of the location and conduct volumetrically analysis to assist the independent agency determine an acceptable response.

The demand and need for this sort of technology to help in emergency response is clear as disaster response groups seek for ways to accomplish tasks easier and more efficiently. The convergence and advancement of technologies, as well as unmanned aerial systems, can grant first responders with huge opportunities to save lots of longer, cash and lives.

III. OVERVIEW OF THE PROPOSED SYSTEM

Many technological breakthroughs in recent years have emerged in areas wherever it had been least expected. Remote-controlled aerial systems, as an example, drones have transitioned from extremely defence-focused applications to a mess of economic use cases that transcend industries. However what makes UAS, commonly named as drones, suitable for emergency response. As previously mentioned, aerial views are critically useful in large-scale disaster zones. Drones, designed to be agile, quick and sturdy, empower response teams with a considerable superiority without costing as much as manned flight operations. As a result, drones will access hard-to-reach areas and perform data-gathering tasks that are otherwise unsafe or not possible for humans. Fig 1 depicts the different domains of disaster recovery where drones are used.

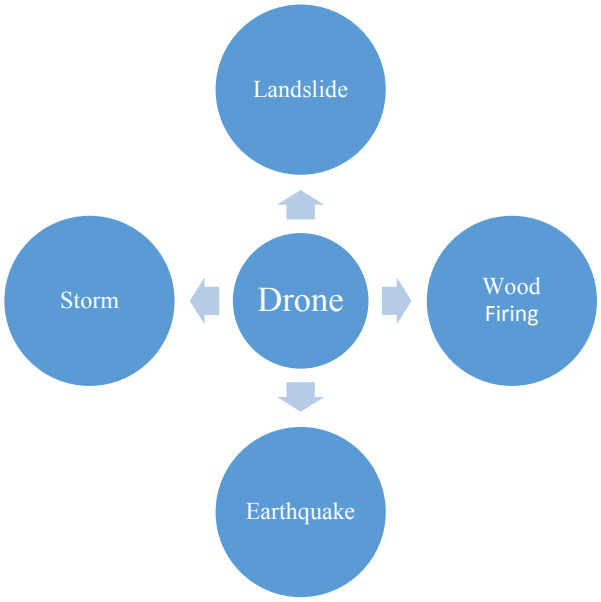

Fig 1: Different types of disaster management using Drone

IV. NOTABLE ISSUES

Many disaster management protocols are tested over the years. Whereas many of those methods are successful, they additionally go with major hurdles. Time is the most vital artefact in disaster response. Emergency responders grasp very well the irreversible consequences of important delays, thus their playbooks are inherently designed to handle urgent, high-pressure situations. On prime of urgency, disaster response faces another major challenge in provision, as seen by the 7.8 magnitude earthquake in Nepal that claimed the lives of 9,000 individuals and injured 23,000 others.

As debris and rubble piled up on the streets following the largest natural disaster in the country since 1934, most of the roads were blocked, denying access to far areas. In situations like this wherever land access is off the table, government agencies are forced to deploy manned aircraft to continue immediate search and rescue, and shortly, relief efforts. In theory, this seems like a winner, however resource allocation, particularly in poorer countries, poses another major challenge. Search & rescue operations from the air are costly, and as we've seen within the past, these operations will stretch for months, even years. In countries wherever resources are already scarce, this feature isn't viable.

Outside of those safety considerations, there's another major hurdle that's usually overlooked: first responder safety. In the case of earthquakes, landslides, hurricanes and wildfires, first responders are deployed instantly in rough and dangerous working conditions. In 2014, a landslip roared through the rural community of Oso, Washington, destroying over thirty homes and taking the lives of forty three residents. The response team had to manoeuvre quickly. The chance of another landslip was looming over them, whereas the primary one dammed the stream and flooded the natural depression, basically turning the complete disaster zone into quicksand. Given of these uncontrollable components, it absolutely was not safe for the bottom crew to research the scene. To form things worse, only 30 minutes of clear skies were left for helicopters to conduct an aerial survey – not enough time to achieve a correct account of what was happening on the bottom. The team did, however, have a drone.

Immediately following the Oso landslide, PrecisionHawk, an information company out of Raleigh that manufactures a drone for information assortment and software package for process and analysis, was known as in through involvement with Roboticists Without Borders (RWB) to produce geologists and first-responders with actionable insights. Using their Lancaster UAV platform, PrecisionHawk surveyed the ground from the air to make a 3D map. RWB's Dr. Robin Murphy recently told CNN, "[The UAV] acts like a plane. It's smarter than a plane as a result of it's got all forms of on-board electronics to let it do pre-programmed surveys. It takes photos like on a satellite or a Mars explorer and then pulls those back together into a hyper-accurate map — a 3D reconstruction."

In Oso, PrecisionHawk used high fidelity sensors and intelligent back-end software system to reconstruct and

analyse the ground in 3D — a step that not only helped geologists discover the pace of land movement however additionally provided 1st responders the time-sensitive information they required to soundly infiltrate the disaster zone. This all happened in a matter of hours. Traditionally, emergency response groups used manned measuring device flights and satellite info to collect such information, actions that are expensive and take days to weeks to accomplish.

Beyond economic and provision benefits, drones currently on the market are usually equipped with intelligent flight coming up with software system that permits first responders to simply produce extremely customizable flight paths that target specific areas of interest, resulting in organized and centred search efforts.

Additionally, drones are outfitted with numerous sensor options that include visual, thermal, LiDAR, hyperspectral and multispectral. Why are these important? In earthquakes and landslides, these sensors are often flown to conduct ground trothing surveys. The thermal device, as an example, is absolutely fitted to detect the heat a human body emits, that helps find survivors. Various sensors suites are economical in getting information to make a definite 3D reconstruction of disaster zones that compared with historical information from satellites, offers new views on the extent of injury, and terrain or field deviation that would facilitate manage future disasters.

With the appearance of UAVs in emergency response, it's necessary to notice that industrial drones operated by professionals and emergency organizations don't supply a similar applications as hobby drones recently seen disrupting inferno containment efforts. Industrial UAV platforms are designed with the on-board intelligence to empower, not deter. So as for drones to become an important part of emergency management, hobbyists have to be compelled to avoid feckless use cases that overshadow the huge advantages of UAV technology and makers have to be compelled to still in-build tools that promote safety.

V. IMPORTANCE OF THE PROPOSED PROJECT IN THE CONTEXT OF CURRENT STATUS

This Quad copter (Drone) has a feature called RTH (Return to Home), during take-off it automatically saves the current location (longitude and latitude) which it is in & for any disruption of signal or after finishing work in hand, it comes back to its home location. The Drone has GPS controlled path setting. User just have to pin a location in the Google Earth. The copter can lift up to 740 grams of weight, the amount can be extended by increasing up thrust. The drone can deliver water, medicines & certain lifesaving equipment in the given location in the time of disaster. The Drone can stream video live via mobile application, which can be recorded and snapshot can also be taken by giving instruction from the mobile application. The Drone can also take clear images of different critical areas in the time of catastrophe & also send the snap to the application. By using the method, it can send the exact GPS location of a taken snap. By using Heat vision camera the drone can spot the alive humans with serious condition stuck in critical areas. The drone can send the location of the alive humans at the time of disaster. The Copter can spray pesticides in any farming field at a consistent rate as commanded by the user in case of any disease affected species of plants. It can also check for crack in any building, structure with the help of x-ray thus preventing the destruction. By the help of the night vision camera it is also fully functional. The drone can broadcast message in the network in which it is operating thus giving a possibility to communicating with other bots/drones at the time of catastrophe. The drone also contains the features of image processing by which it can serve its purpose in unknown location (GPS) areas & after finding the area it can send the location to the user. It is as lightweight and flexible so it can enter such critical areas that is humanly impossible. It has easy replaceable battery on its top that battery can be changed easily anytime.

VI. CONCLUSION

The proposed scheme consists of a system and a method to provide a secure and robust mechanism for a quad copter, such that establishing communication between quad copter and operator can be easier. According to one embodiment, through a transmitter this quadcopter can be controlled manually but the transmitter must have 4 channels. According to one embodiment, a function called RTH (Return to Home) is provided which gives a safe operation to it; as will automatically come back to its starting point safely, if any disconnection happens

with its operator. According to another embodiment, live streaming with recording and snapshot possible via mobile application. According to another embodiment, a method is called image processing; through which any product can be delivered to a particular location as well as particular position (in front of any window or any door or whatever position can possible via image processing).

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