



*International Journal Of*  
**Recent Scientific  
Research**

ISSN: 0976-3031  
Volume: 7(3) March -2016

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THE OFFICIAL PUBLICATION OF  
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)  
<http://www.recentscientific.com/> [recentscientific@gmail.com](mailto:recentscientific@gmail.com)



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

*International Journal of Recent Scientific Research*  
Vol. 7, Issue, 3, pp. 9191-9194, March, 2016

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## REVIEW ARTICLE

# REVIEW OF UAV BASED SOUND SENSING FOR SEARCH AND RESCUE OPERATION

**Sheeba Thamilselvi A and Gopinath. P.G**

Department of ECE, GRT Institute of Engineering and Technology, Tiruttani, India

### ARTICLE INFO

#### Article History:

Received 16<sup>th</sup> December, 2015  
Received in revised form 24<sup>th</sup>  
January, 2016  
Accepted 23<sup>rd</sup> February, 2016  
Published online 28<sup>th</sup>  
March, 2016

#### Keywords:

UAV, Public Safety Communication,  
Sound Sensing, Audio communication,  
Wireless Technology.

### ABSTRACT

Nowadays GSM system is the most essential technology in cellular network communication. This will get damage due to some harmful effects such as cyclones etc., Network capturing using GSM manual system will leads to time delay. So this affects the emergency communication in disaster area. Then the antenna will not be reused when using GSM antenna in higher buildings. It is a fixed monopole antenna. If it is dismantled, the entire system will be affected. So UAV is implemented to avoid the availability problem of network in disaster area. The emergency communication is provided by SMS or voice call. Software Defined Radio (SDR) is a platform which is used to run BTS. Here SDR acts as a small base station. To transmit and receive the signal, the Universal Software Radio Peripheral (USRP) is used. It acts as a transceiver device. The existing system will not rescue the people those who are invisible to search and rescue mission. In this proposed system, we developed the sound sensing technique to sense, monitor and record the audio signal of the affected person in invisible area. This involves implementing a signal processing system for audio sensing by using audio sensor network. It consists of microphones to share the information. UAV will record the information from microphones.

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## INTRODUCTION

In this world, cellular network plays important role. But it will get damage due to some harmful effects such as cyclones, flood and wildfire. This will affect the emergency communication among the users. In this paper, UAV is implemented to avoid this problem. This UAV will capture the network and gives it to the mobile users. It acts as a base station [1]. In [2], the author describes about the Acoustic sensor which deals with the sound detection. These sensors are used to sense the sound by tracking, detecting the vehicles and weapons. The signal processing algorithm was implemented here. This algorithm is used for autonomous sensing in the battle field application to sense the weapons and vehicles. In 2008, the author contributes the use of UAV for many applications. In this paper, it plays an important role in civilian and military application for public concern. Many types of UAV's were described such as MAV/Mini UAV, Tactical UAV, Strategic UAV, Special task UAV are used for public concern. MAV/Mini UAV's are the smallest platforms at smaller attitudes which fly over inside the buildings. Tactical UAV's are used in higher attitudes and it is primarily used for military purpose. Strategic UAV's are used for higher attitude and heavier platforms for payloads. The

special task UAV's are used for the purpose of Navigation, Network infrastructure, Disaster application and Collision avoidance in air [3]. In Korea, disasters have been the most serious harmful effects. In this paper, the author implemented an UAV using multisensory approach. By using spatial hierarchical approach the flood related damages can be estimated. Multi-sensors are used over the same sites for the purpose of SAR imagery, UAV imagery and Ground based observation to saves government money. it provides high accuracy more than manual approach. The Synthetic Aperture Radar (SAR) uses active sensors to sense in Water area for flood monitoring [4]. Later, the networked UAV is implemented with Aerial sensors. This aerial sensor plays an important role in disaster application by delivering high quality images and video. In this paper, the UAV will capture the image or video of the disaster area by wireless camera and informs to the search and rescue mission. The coverage problem can be formulated by cameras and sensors. This can find the affected person too [5].

The UAV's are familiar with defense application. In this paper, it uses unique tools to destroy enemy. The lethal and non-lethal weapons take place in UAV to transform the way of armed forces. The author describes about an UAV to destroy the

\*Corresponding author: **Sheeba Thamilselvi.A**

Department of ECE, GRT Institute of Engineering and Technology, Tiruttani, India

enemy [6]. UAV acts as a subsystem which is the integral part of a system consist of payloads. In this paper, author suggested an idea of UAV's function in several application such as Aerial photography, Rural rustic, littoral, conservation, customs and exercise, power related companies, forestry services, fisheries and military purposes [7]. Later, an UAV with remote sensing was designed for civilian application which includes the public safety communication. In this paper, author submits his idea about UAV which enables in-depth military observation of an area carried out to locate an enemy or gain information and surveillance of major incidents. This is as well as plays role in disaster application such as firing, liquid or gaseous contaminants. So the civilian concepts of operation were suggested as a system level for wireless communication network. This improves the rescue workflow even with fewer expenses [8]. Acoustic sensors are the sensor which detects the sound through the microphones and to place the battlefield threats. In this paper, a new type of sensor called Acoustic Vector Sensor has been accomplished. It is a 4 channel sensor with sound pressure microphones which find out the battlefield noise. The battlefield threats are Rockets, Artillery, Mortars and gun shots [9]. The quad rotor UAV is a high cost system. In France a student group prescribes the low cost quad rotor UAV which forms the architecture and controls UAV. This architecture and control is for surveillance, observation and security [10]. In recent inventions, the UAV is implemented with Anti-collision system. This contains array of microphones to process the signal. In this paper, the author submitted his idea about the Denoising algorithm for rotating machinery. This will detect the effect of wind and vibrations also [11]. In disaster application UAV's are used to detect the visible person. This is not a reliable search and rescue operation. In this paper, to avoid this problem, sound sensors are used to detect the invisible person in the disaster area [12].

In urban and rural areas, the UAV's can deliver the goods. It plays an important role in non-military application. This is a small UAV which can deliver the goods in road side as for public concern [13]. Battery level in the UAV gets low due to the high level operations. So solar panels are attached in the UAV for automatic charging. Wireless power transfer sensors are used in large dams to prolong the sensor network lifetime. According to the laser power beaming technique, the sensor will be charged which is connected in bridges. Batteries are the primary energy source [14]. These flying robots are used for humanitarian purpose. In this paper, the author describes about the flying robots which comes under the lifesaving technology such as delivering vaccines to the peoples and delivering food to the peoples [15]. The existing UAV's cannot carry payloads but it has high precision and fast localization. Here, the author contributes the micro air vehicles which are used to carry payloads and it allows fast deployment. The hazardous avoiding autonomous landing system also included in this paper for navigation purpose [16]. Later, sound sensors with gyroscopes were implemented to find the direction. It is to find the direction of the disaster area and as well as person. It has consumer grade speakers to share the information [17].

This flying UAV's are used for search and rescue operations in disaster areas. It contains some sensors to find out the routes

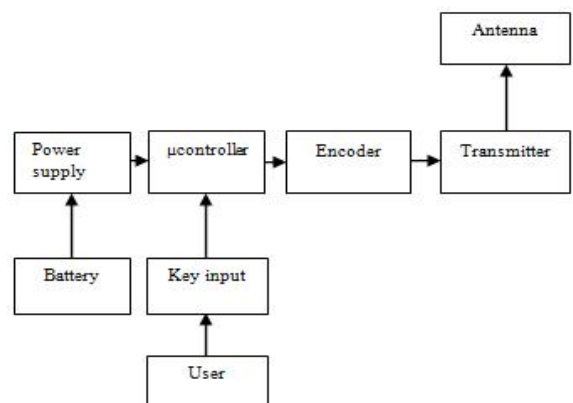
for disaster area. It maintains the connectivity between robot and system this UAV's are especially used for underground disasters such as smoke damage. Robot wireless sensor network is used in this paper to gather the information about disaster area [18]. Nowadays, Safety maneuvering in indoor and outdoor system is the important system. In such a case, some collision will be occurred. In this paper, the author suggested his idea of collision avoidance system in UAV. The aerial vehicles in the indoor environment will collide with objects. So wall collision avoidance system is developed by using ultrasonic sensor. This sensor will sense the object which is near to the UAV. This is the important system in UAV based systems [19]. Drones are used for disaster response and relief operation such as flood damage, earthquakes, loss of power in dispensaries, road destruction etc., [20].

### Unmanned Aerial Vehicle

An unmanned aerial vehicle (UAV) is the most complex system whwn comparing with computer system. Several elements are used in this flying system such as launching, landing, recovery, communication. This flight can be controlled by remote controlled pilot. It is used for several application such as electricity companies, agricultural purpose, fisheries etc., [7]. The types of UAV is given below.

### Types of UAV

- HALE(High Altitude Long Endurance)
- MALE(Medium Altitude Long Endurance)
- TUAV(Tactile UAV)
- Close Range
- Mini UAV
- Micro
- NAV(Nano Air Vehicles)
- RPH(Remotely Piloted Helicopter)
- Quad copter
- Hexapod



**Fig.1** Block Diagram of UAV Remote

The basic operation of UAV is given as follows. It contains three sections they are, Remote control, USRP, Flying model. The user input is given through the remote. The input is given to the microcontroller to control the direction of the copter. Here, the power source is the battery which is used to operate

the entire system. Then the data is encoded and transmitted through the RF transmitter antenna. USRP is a transceiver device which is used to transmit and receive the information through the RF transmitter and RF receiver.

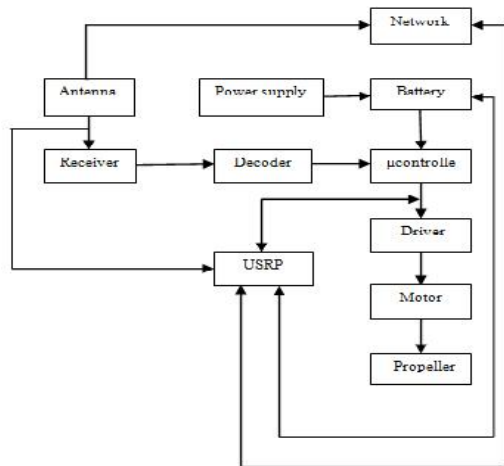


Fig. 2 Block Diagram of UAV

Flying model consist of individual microcontroller, power supply etc. the signal is transmitted to the RF receiver through the antenna. Then the signal will be decoded and controlled by the microcontroller. This microcontroller is used to control the USRP and driver. The driver can drive the motor which enables the propeller.

**Public Safety Communication**

Nowadays, cellular network communication plays an important role in GSM technology. But during natural disaster network gets damage. This cannot be rectified by the existing system such as GSM antenna which is placed in the higher buildings. So UAV, an Unmanned Aerial Vehicle is implemented to capture the network in disaster area. This uses Software Defined Platform (SDR), which acts as a base station to control the BTS. The message will be shared via Universal Software Defined Radio (USRP). UAV can be controlled by the remote control (Pilot). The height of the RC quad copter depends upon the battery level [1].The basic block diagram of cellular network capturing for GSM system using UAV is given below. This contains transmitter, receiver, temporary network and permanent network. By using Unmanned Aerial Vehicle Network 2 will be activated only when network 1 gets fail. The microcontroller is used to control the USRP. The beagle bone black microcontroller is used. This is based on the software define radio (SDR) which is an equipment used to run BTS [1].

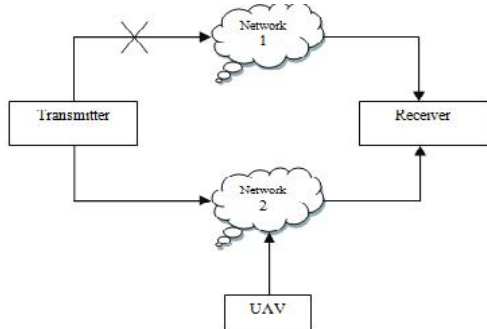


Fig. 3 Overview of Public Safety Communication

UAV is a cheaper and readily one to rescue the people and area in disaster condition. This is most commonly used for public safety communication where there is network is unavailable. This is used in the applications such as flooding, landslide risks and volcano eruption. By using sensors and cameras, it will sense the voice and as well as the direction of the area in global environmental services.

**Proposed System**

UAV is implemented to avoid the availability problem of network in disaster area. The emergency communication is provided by voice call. Software Defined Radio (SDR) is a platform which is used to run BTS.

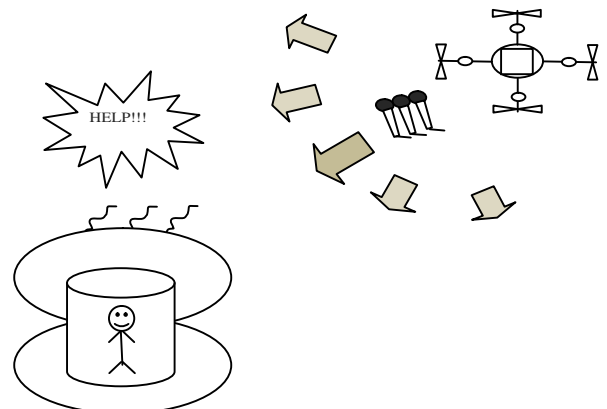


Fig. 4 Example diagram of sound sensing UAV in disaster area [13].s

Here SDR acts as a small base station. To transmit and receive the voice signal, the Universal Software Radio Peripheral (USRP) is used. It acts as a transceiver device. The existing system will not rescue the people those who are invisible to search and rescue mission. So by using sound sensors, the audio of the affected people will be sensed, monitored and rescued by the SAR mission. This involves implementing a signal processing system for audio sensing by using audio sensor network. It consisting of microphones to share the information. UAV will record the information of microphones [13]. The hidden object detection is very difficult in disaster area. So we proposed that the hidden and invisible person and area can be detected by sound sensors and microphones in UAV.

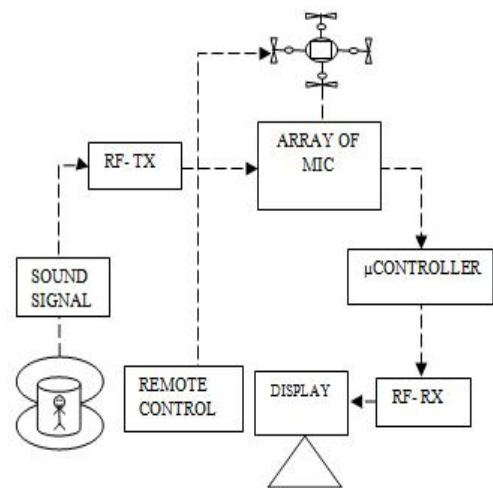


Fig. 5 Main Block Diagram of Sound Sensing by UAV



The above figure shows that how the unmanned Aerial Vehicle sense, monitors and records the information of person in invisible area. UAV consist of four sound sensors to sense the voice which helps to find the disaster area and as well as person. It contains array of microphones to share the information and the UAV records the information. By hovering process, the UAV moves in all direction to find the area. Once the area has sensed, the direction and place is indicated in monitor and shares the information to search and rescue mission. It has several kinds of built-in sensors: a inertial measurement unit, ultrasound telemeters, and cameras for ground speed measurement. The data collected by these sensors are called navigation data, which is abbreviated as navdata. UAV is generated mainly around the motors and rotors. Since the microphones have to be attached near these noise sources to prevent a loss of thrust.

## CONCLUSIONS

In this paper, we reviewed an UAV in sound sensing and we implemented a system which have sensed, monitored and recorded the information in UAV by using microphones to rescue the person in invisible disaster area. The result of the sound sensing has been showed in display in which the direction and disaster area is monitored. The sound will be detected by self-monitoring sound sensors. The experimental results demonstrated that our method improves the safety communication.

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