DronAID

A Smart Human Detection Drone for Rescue

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***Abstract*— Natural calamities have recently opened their doors to disasters which in turn have affected various regions of the world. Disasters serve as an eye-opener as they are unstoppable and exceptional events which are either natural or manmade, such as earthquakes, wildfires, floods and terrorist attacks etc. These natural catastrophes many a times serve as a hats down chink in the armor as they lead to a massive death toll either because of people being stuck in the debris or due to no help received on time. One of the major challenges faced by the rescue and search teams during a massive disaster is the actual search of survivors and victims at the earliest and also reaching out to far off areas to make sure people are not stuck under the debris. This paper presents a real time autonomous drone technology system named "DronAID" that is capable of detecting humans in disastrous conditions. This system assists in the rescue process by identifying the exact location of the survivors at the earliest. As the system is a drone based system, it can easily be mobilized and controlled. This system comprises of a monitoring system along with a camera module and sensor unit to identify the existence of humans buried under the debris. The system sends the data ahead for further action and investigation. We believe DronAID system is the need of the time and will prove to be a blessing in disguise in calamitous situations and will serve as a significant requirement in urban disasters.**

Keywords—disaster; debris; drone; security; survivors; PIR sensor; victims; catastrophy; calamity.

I. INTRODUCTION

In disastrous situations like wars, tornados or earthquakes, one of the major challenges for the rescue and search teams is locating and finding survivors and victims at the earliest [1]. However, in these cases rescue teams fail to sense the actual status of the life beneath the debris which finally leads to death. Moreover, disasters lead to such a devastating effect on the body which makes it further more difficult to differentiate between a human and material. This leads to a massive amount of people losing their lives; an uncontrollable situation.

Rescue teams in such situations are unable to reach certain sensitive areas due to the immense amount of debris. It becomes impossible for them to rescue people as they are unable to reach such areas. On the other hand, some existing systems that are controlled by robots are ineffective, because due to earthquake or any other disastrous condition, humans get stuck underneath the debris which makes it difficult for the robots to walk over broken and ruined buildings [2].

Due to all these problems, enforcement of a tailor made rescue framework is of prime importance. The proposal of DronAID has therefore been laid down in the light of all the issues. It is designed using drone which will enable it to overcome many of the disastrous problems. The system is capable of saving the lives of victims in real time.

DronAID rescue system 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. It captures images and sends it further for monitoring the affected area. The system has Passive Infrared Sensors (PIR) to detect radiations generated by human body [3].

The contribution of this paper can be summarized as:

- DronAID drone can be used at the time of natural calamities to save the lives of humans for rescue purposes.
- This system is also useful for monitoring the affected area.
- This system can also provide aid to humans in areas where rescue teams cannot reach.

We have divided our paper in various sections. In the first section we have discussed related working of other existing systems. In the second section we have presented

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our proposed system and its working. Additionally, the paper précises the application of the system and finally the conclusion.

II. RELATED WORK

Disasters produce a devastating effect which makes it very difficult to distinguish a human from a material. This leads to a great loss of lives.

Many systems have been designed to solve this problem. Live Human Detection Robot[4] is an embedded system having a set of well-defined sensors which includes temperature, PIR, Ultra sonic, IR, vibration detector and more sensors that indicates the system about the status of the human body. An alert message is sent to the control rooms of affected areas using GSM technology to give immediate rescue to the victims using PLC logical programming [5].

Wireless Human Detection Robot [6] deals with the live human detection. It is a remote controlled robot that utilizes PIR sensors to detect the existence of humans and indicate user via a signal. As it is a remote controlled robot it can easily be controlled and mobilized. This can be also utilized to detect thieves and terrorists.

Mobile Rescue Robot for Human Body Detection in Rescue Operation of Disaster[7] project proposes a rescue robot which moves in earthquakes, disasters prone area to help in detecting injured people, living people, their location and other rescue operations. Hence due to timely detection of people in natural disasters this system can rescue precious lives and reduce the percentage of a massive loss along with less percentage of rescue operations. The proposed system comprises of a mobile rescue robot and a PC controlled module.

Whereas DronAID system is designed on Drone that makes the rescue operations efficient. The system has PIR sensor technology to detect radiations generated by human body. The system sends location of the victims to the rescue teams, so that the rescue teams can locate the victims at the earliest. It captures images and send further for monitoring the effective area.

Table I. Comparison of Existing systems and DronAID system.

Projects	**Features**				
	Human Detection	***Live Streaming***	***Sending Location of victims***	***Image Capturing***	***Image Processing***
Live Human Detection Robot	✓	✗	✗	✗	✗
Wireless Human Detection Robot	✓	✗	✗	✗	✗
Mobile Rescue Robot for Human Body Detection in Rescue Operation of Disaster	✓	✓	✓	✗	✗
DronAID	✓	✓	✓	✓	✓

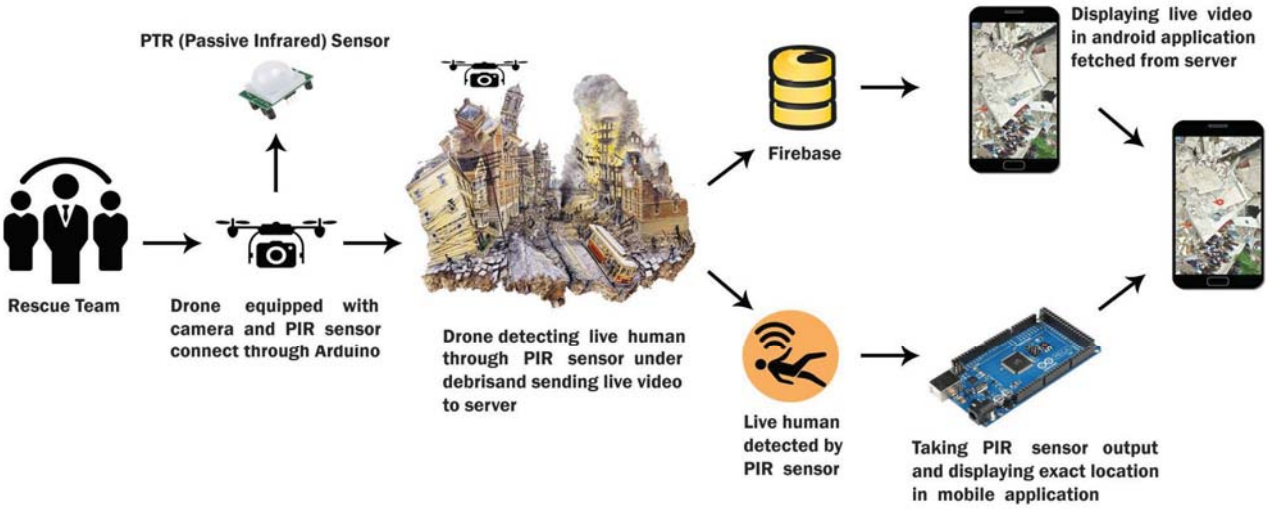

Fig. 1. Work Flow Diagram of DronAID System

III. DRONAID SYSTEM

DronAID system is designed on Drone that makes the rescue operations much more efficient. The system has a PIR sensor technology to detect radiations generated by human body. The system sends the location of the victims to the rescue teams, so that the rescue teams can locate the victims at the earliest and rescue them in real time.

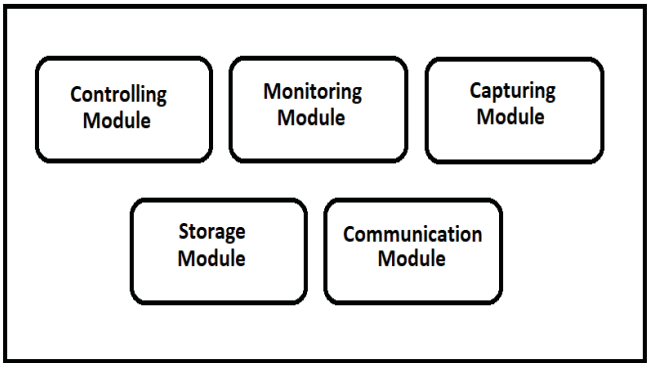

Fig. 2. DronAID System Modules

The hardware components of this system are microcontroller (ATmega2560), PIR sensor, Wi-Fi module, camera (OV7670) and SD Card. Android Studio and Arduino IDE are the software tools used to design the system.

The DronAID system consists of various modules which includes; microcontroller module, sensor module, data storage module, Wi-Fi module and camera module. Each module working is discussed in detail below.

A. *CONTROLLER MODULE*

The ATmega2560 is used to design the System of DronAID. Following functions are performed by the microcontroller in the system:

- Receive the signals from the sensors and process them.
- Send signals to the database.

B. *MONITORING MODULE*

The core part of the system is the PIR sensor. The system functions on the infrared radiations that are emitted from a human body. Infrared radiation (IR) has a wavelength of 0.7 to 300 micrometers.

Humans emit infrared radiations. It has been assimilated that a human body radiates IR at a wavelength of 10 micrometers to 12 micrometer [8]. PIR sensor is a passive electronic device that detects motion by sensing an infrared fluctuation [9]. It consists of three pins (drain, gate and source). A high signal is redirected to alert the pin when the PIR detects an IR radiation [10].

This module is accountable for detecting human position in the disastrous conditions like earthquake and sending those signals to the microcontroller in order to notify the rescue teams about the location of the victim [11]. This module consists of a PIR sensor for detecting humans by the infrared radiations that are emitted via the human body.

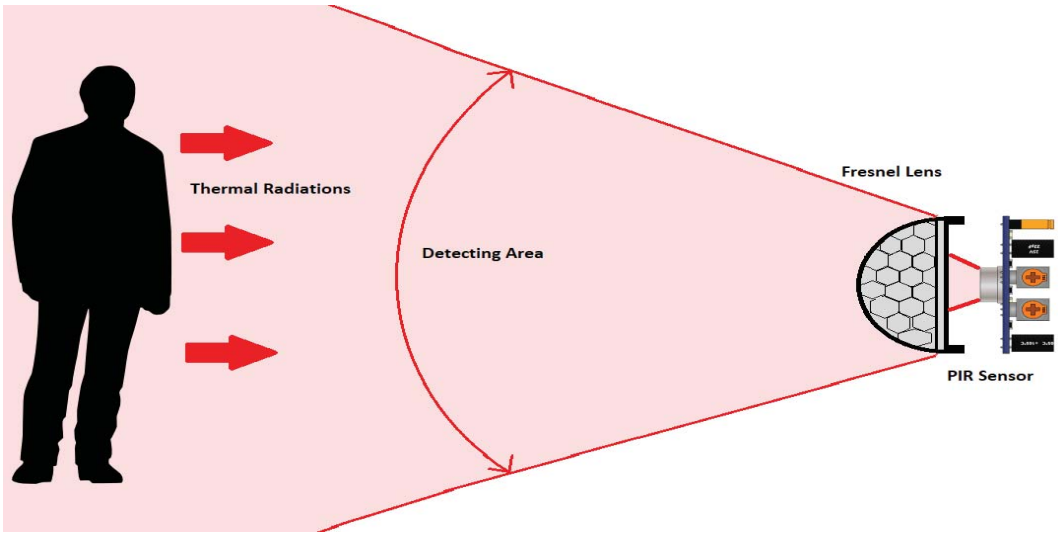

Fig. 3. Passive infared sensor working

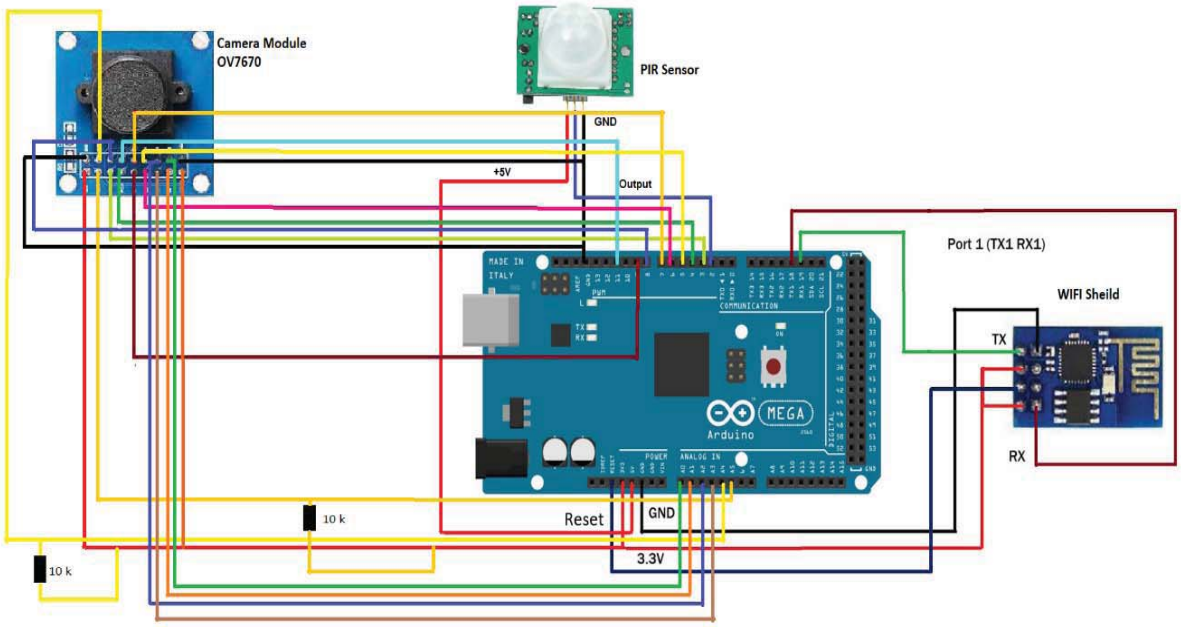

Fig. 4. Simulation of Microcontroller.

C. *Communication Module*

This module consists of a WI-FI and is accountable for the communication between the application and the server. If communication between the server and application is not established, live streaming will be constrained from travelling from the server.

D. *Capturing Module*

This module consists of a camera. The camera sends live video streaming of the affected area and helps locate the victim's exact location. It also captures the images of the affected area and send data for further processing.

E. *Storage Module*

The images of the affected area are stored on a server that are sent further for processing. Admin can request more pictures of an incident for further processing and investigations. Furthermore, personal information of security teams are also stored in the database.

IV. System Deployment

The proposed system is tested and implemented to suit the desired problem and its solution. Figure 5 shows the aerial view of the collapsed building displayed in live streaming via the mobile application. The locater in the live streaming is indicating the conscious human's location under the debris. The human is detected from a range of 8 meters. By knowing the exact location of the stucked human, rescue team can save their life at the earliest. DronAID system has the ability to achieve high performance rank by detecting humans who are alive in devastated environments and that too at a relatively cost effective price and more efficiently.

Fig. 5. Aerial View of a Collapsed building.

V. Conclusion

The DronAID system is built using drone, minimizing the limitations associated with robots that are static [12]. The use of drone makes the system more efficient than robots that have failed in disastrous conditions like the earthquake because when humans get stuck underneath the debris it makes it difficult for the robots to walk over the broken and ruined buildings [13]. DronAID is a real time autonomous drone technology system which is proposed for detecting humans in disastrous conditions and intimating the rescue team about the exact positions of the effected human.

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