International Journal Of Advanced Research In Engineering Technology & Sciences
ISSN: 2394-2819
Email: editor@ijarets.org March- 2015 Volume 2, Issue-3 www.ijarets.org

Aerial Disaster Assessor and Mitigator

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ABSTRACT:-
This paper introduces a model for an Aerial Disaster Assessment robot that can be primarily used in search and rescue operations and act as an aid in recovery operations in case of natural disasters such as earthquakes, floods etc. as well as in everyday emergencies such as fires in homes or factories. The purpose of building this robot is to allow quicker response to survivors in an emergency by significantly reducing the time it takes to locate a survivor and ascertain his condition, allowing improved response time by proper authorities. It also helps in providing a quick overview of the affected area. In any emergency, time is the most essential resource and information is the scarcest resource. Our model attempts to decrease the time taken to gather information, thereby directly contributing in saving lives. It acts like a mobile rescuer that directs actual rescue efficiently to those who need it most.

INTRODUCTION:-
A.D.A.M. consists mainly of two parts: The first part consists of a four wheel differential drive which helps it move around on the ground and squeeze through tight spaces, that would be risky to fly through, and the second part consists of four brushless dc rotors which enable it to fly and reach high and/or inaccessible places as well as cover large distances quickly. These two parts operate independently of each other and in case either one fails, the robot is still operable.
Besides this dual functionality the robot possesses optical cameraand sensors to monitor air quality as well as the surrounding temperature. The optical camera allows the operator to get a bird's eye view of the affected area in real time and helps spot people in need of help. The air quality is monitored by a Carbon monoxide sensor which ensures quick identification of potentially dangerous environment as it is an odourless, deadly gas and especially in case of fires the leading cause of death. The temperature sensor gives real time reading of the temperature and together all these sensors give a clear idea of what the situation is at ground zero.
ADAM follows a standard X configuration quad copter in its design but has a wheel base of 13 cm x 20 cm. The wheel base is custom made. A six channel transmitter allows wireless operation by a human controller. The optical camera, temperature sensor and carbon monoxide sensor have independent transmitters. All this data is relayed back to a personal computer via radio transmitters where is can be viewed as a video feed and discreet values for temperature and carbon monoxide concentration (in parts per billion).

OPERATION:-
The whole setup is powered by an 11.1 V 2200 mAh 3S Lithium Polymer battery. There are four brushless direct current motors (out runners) of 1400 kV each capable of rotating at about 15500 rpm. The wheel base uses four direct current motors of 12 V attached to four wheels respectively. In an emergency, such as a fire in an urban environment, ADAM can be deployed as soon as the call for help is received towards the scene of fire. As soon as it reaches the burning structure, it relays back video feed and in going near the structure can pick up what kind of fire it is by checking the surrounding temperature and the carbon monoxide content. It can also go in the structure and give an inside view to determine if there are people trapped or unconscious and also

give an idea of the environment inside the house which will give the fire fighting unit an idea of the level of fire protection needed. All this data is gathered even before the actual fire fighting team gets there.

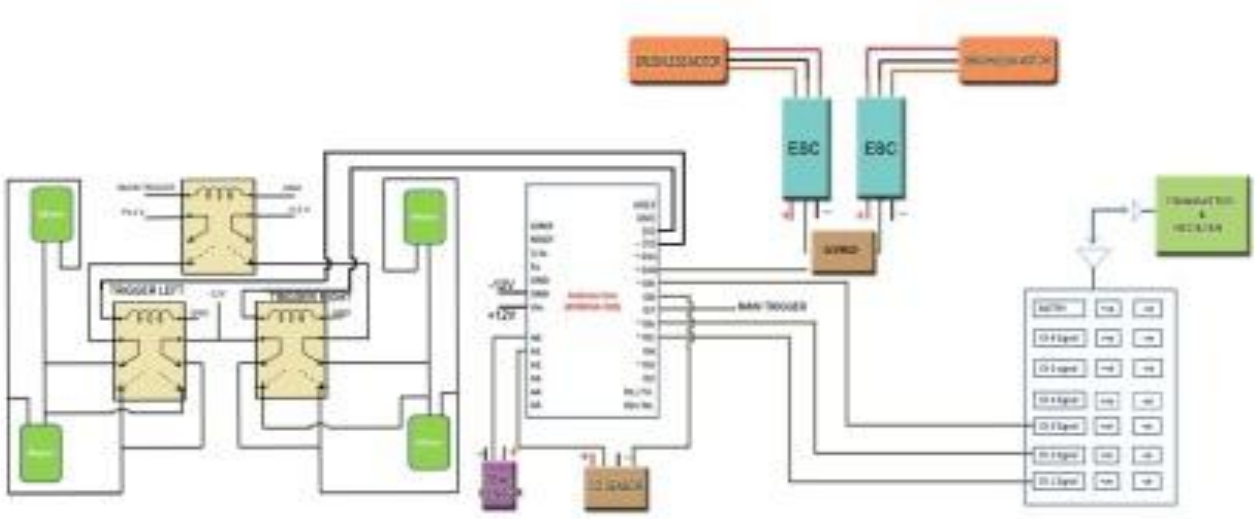
In a large scale disaster such as an earthquake or a flood, a fleet of such robots can be sent out to gather data on the extent of damage as well as to look for people trapped or injured at homes. On gathering relevant data, priority based rescue can be initiated. ADAM can be launched from a mobile vehicle or even a boat to reach say top floors as is typical in floods.

The wheels are disabled in flight and can be used only when on ground. This switch from air to ground mode is done by using a relay circuit consisting of three Double Pole Double Throw relays which work on 5 V supply from the microcontroller on-board. An Arduino Uno board and an Arduino mini with an ATMEGA 328 are used to control all the parameters during flight as well as on the ground at either end.

COMPONENTS USED:-

1. Four Brushless DC Motors
2. Four DC Motors
3. Arduino Uno Microcontroller
4. Arduino Mini Microcontroller
5. Three DPDT Relays
6. MQ 7 CO Sensor
7. LM 35 Temperature Sensor
8. Four 10 x 4.5 Propellers
9. Six Channel transmitter
10. Six Channel Receiver
11. 2200 mAh 11.1 V Battery
12. Optical Camera
13. Gyro module MPU 9150
14. RF 433 MHz Transmitter Receiver

CIRCUIT DIAGRAM:-



CONCLUSION:-

This design can help save lives in everyday emergencies as well as in full scale calamities by shortening the time it takes to gather information and so in directing rescue and supplies quickly to those who need it most. It uses open source software and mostly open license hardware to enable better customisation as per local requirements and disaster specific customisation. The design was done keeping in mind recent problems during disaster mitigation and how best to tackle those problems.

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