

RDrone

Feasibility Analysis

1. Introduction

The raport contains results of the technical feasibility analysis of RDrone product – the rescue drone equipped with radar for sensing the disaster survivors. The analysis included: specification of intended use and functional requirements, analysis of the state of knowledge and solutions available in the market, initial project risk assessment and regulatory aspects. Based on performed research a technical solution concept was prepared.

The report was prepared for demonstrational and self-improvement purposes.

2. Intended use

The RDrone is a drone intended for surveillance of the disaster zones and detecting the survivors both on the surface and those trapped underneath debris. The system consists of the drone itself, control station and accompanying software and accessories. RDrone is intended for use by emergency units – appropriately trained professionals in the environment after natural disasters or war zones.

2.1. Functional requirements

Functional requirements were prioritized into three categories:

Must have – the essential requirements allowing the product to achieve its basic goals.

Should have – the requirements addressing important, but not essential aspects of the product, lack of their implementation will decrease the final value of the product.

Nice to have – the requirements increasing the final value of the product, but not deeply connected to the desired principle of work.

Must have:

1. Detection agent allowing for movement through and scanning of the disaster zone.
2. Detection of survivors:
 - a. on the surface,
 - b. beneath the rubble for 10 meters deep.
3. Manual control.
4. Wireless communication.
5. Continuous work for min. 2 hours.
6. Compatibility with procedures used in disaster zones.
7. Control range for up to 1 km.

Should have:

1. Detection of survivors beneath the rubble for 20 meters deep.
2. Automated detection and counting survivors in specified areas.
3. Live-streaming video from the agent.
4. Continuous work for min. 5 hours.
5. GPS navigation.
6. Control range for up to 5 km.
7. Protection against adverse weather (both control and detection agent).

Nice to have:

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1. Communication and data export with the rescue teams.
 2. Automated scanning movement through the designated sector.
 3. Control range for up to 10 km.

3. State of knowledge

Natural disasters protocol

- the definition of disaster? – for description of the environment
- the emergency units action protocols
- the equipment used

Survivors detection

- surface detection methods
- rubble detection methods

State of knowledge summary

4. Market research

Life detection equipment

- probably some probes or radars for rubble
- radars for warfare, through-wall detection

Life detection systems

- probably some drones with cameras and thermal imaging
- maybe warfare drones with radars?

Market research summary

5. Risk analysis

Users and survivors health and safety

- missing the survivor – low detection accuracy
- loss of control over UAV – training required, backup procedures, backup connectivity,
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System's effectiveness

- false positives of detection – wasting resources
 - insufficient battery
 - inappropriate use – training required
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6. Regulatory aspects

Market introduction

- is it MDR? or appropriate aerial regulations? or both?

Standards and legal requirements

- regulations
- applicable standards (harmonized would be best)
- flight permission

Accredited tests

- if applicable
 - RED tests will be for sure
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7. Technical solution concept

System architecture

Detection agent

- vehicle platform, requirements - UAV
- maybe some ready UAV with enabled modifications???

Sensory detection units

- proposed algorithm
- exemplary sensors

Vehicle control units

- like accelerometers, motors etc.

Power management

- brief estimations of required power
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MCU

- examples of MCU's
- recommended one

Connectivity units

- satellite module
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Control station

Movement control

- mcu and
- joystick or what is required to steer

Connectivity

- the same as in detection agent
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- probably some serious antenna

User interface

- screen
- example of existing user interfaces

Industrial design

- examples of drones
- examples of controllers
 - recommended design
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Efficiency and safety verification

- validation procedure?
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8. Conclusions