Robots for Fire Fighting

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Firefighting is one of the most hazardous careers in the world. Firefighters need to extinguish fires in hazardous environments, carry equipment and take care of his own safety as well as save fire victims and properties. According to the statistic by International Association of Fire Fighters (IAFF), the death rate of US firefighters per year, is around 1.9 firefighters per 100,000 structure fires (IAFF, 2000). However, the number is increasing to 3.0 per 100,000 structure fires (Kyle, 2007).

Firefighters die in the line of duty because of burns, falling structures, explosions, crushing injuries and related trauma (Rosmuller and Ale, 2008). In a fire, firefighters can face various kinds of hazards and life threatening conditions including building collapse, corrosive gas, explosion and radio activity. In United Kingdom, Belgium and the Netherlands, firefighters are not allowed to enter burning buildings. This move is to avoid fatalities when firefighters are trapped in the buildings.

Equipment such as helmet, gloves and flat head axe are not enough to protect firefighters from danger. Firefighting techniques and technology must be improved to reduce fatalities among firefighters.

Currently, a lot of research and development is being carried out around the world to develop robots that can assist or replace the firefighter.

Different kinds of firefighting robots have been used by fire services departments around the world such as Hong Kong and Singapore. These robots are able to help the firefighter extinguish fires, carry the necessary equipment, search for victims and conduct surveillance in hazardous environments.

Technological advances have also improved firefighting equipment and reduced the rate of fatalities among firefighters. One such advancement is the application of robots.

Photo 1: The robots are designed for use in hazardous environments

Different type of robots have been developed and used around the world. The Austrian made LUF60 (NRT, 2013) is a diesel-powered machine equipped with an air blower and a water beam fog. At high speeds, air will mix with the water and turn into fog to help extinguish the fire. The LUF60 can also blow water to a distance of up to 80m.

The FIREROB (American crane, 2012) robot is equipped with a heat shield and high pressure water mist extinguishers to fight fires. The robot can also be installed with a thermal imaging camera and sensors for feedback purposes.

Croation manufacturer DOK-ING (DOK-ING Company, 2010) has developed a multifunctional 9-ton firefighting robot. This is the biggest long range (1500m) remote control technology GPS-INS (Global Position System – Inertial Navigation System.

JMX-LT50 (Chinawe, 2013) is a remote-controlled firefighting robot developed by the China manufacturer. It is equipped with a water cannon that can spray water in different angles and for different distances. It uses tyres to move around.

In the US, a firefighting robot, Thermite (Howe and howe, 2013), was developed to fight urban fires, forest fires and industry fires. The Thermite can be controlled from a distance of 400m via a multi-directional monitor; this will ensure the safety of the operator. The Thermite is designed for use in both rough terrain as well as building environments.

The Fukushima Daiichi nuclear plant, which was

damaged by a tsunami, was inspected by a robot named iRobot PackBots (Hornyak, 2011). It was deployed at the nuclear plant to record radiation levels.

MyBOT-X is a remote-controlled machine consisting of a mobile and rigid chassis. It can be controlled wirelessly at distances of up to 500m. Its nozzle can be directed at different angles and even elevated when required, for fighting fires at different heights. The modular-based mobile robot was developed to reduce the risks faced by firefighters when performing their duties.

It is light weight and is equipped with long-range control ability for firefighting and victim search purposes. The robot can be used for surveillance, object clearance, inspection and compound guiding by changing the top part of the robot (Tan *et al., 2013*).

Photo 1 shows model of the MyBOT-X for hazardous environments. Unfortunately, the current robot is unable to withstand very high temperatures assome of the electrical and electronic components are affected or destroyed by the heat from the fire. To overcome these constraints, the robot may be installed with a heat shield or a sensor system in futurefor protection. Research and development is being carried out to improve the performance and reliability of the MyBOT-X.

MYBOT-X FOR FIGHTING FIRES IN A HAZARDOUS ENVIRONMENT

Although the robot has been developed to replace the firefighter to reduce the risks that the latter faces, a firefighter's experience and knowledge are invaluable and these cannot be replaced by a robot.

The robot can be deployed in highly hazardous areas such as petrochemical plants, radioactive environment, unstable structures and high pressure vessels. ■

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