Robot in Intellegent Surveillance System : A Review

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***Abstract*— Technology has become the solution to many long-standing problems such as huge, complex, difficult and challenging tasks associated with disaster missions and risky intervention. To find creative, reliable and applicable technical solutions in such highly constrained and uncertain environment is a challenging task and it is necessary to overcome constrains on resources by developing innovative, cost effective and practical technology. Robotics can play important intelligent and technological roles that support in harsh and dangerous environments while replacing rescue personnel from entering unreachable or unsafe places. The increasing need for intelligent visual surveillance in commercial, law enforcement and military applications makes automated visual surveillance systems one of the main current application domains in computer vision. This paper emphasizes the use of robotic technologies for disasters prevention or early warning, intervention and recovery efforts during disasters with all possible kinds of relevant missions while ensuring quality of service and safety of human beings. Some of these missions may include: demining, search and rescue, surveillance, reconnaissance and risk assessment, evacuation assistance, intrusion/victim detection and assessment, etc. This survey concludes possible future technologies.**

Keywords— ***Robotics, disasters, surveillance, search, rescue***

I. INTRODUCTION

Robot can be defined as "a machine that looks like a human being and perform various complex acts; a device that automatically performs complicated, often repetitive tasks; a mechanism guided by automatic controls." ISO describes a robot as "an automatically controlled reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications". Robot comprises of motors, pulleys, gears, gearbox, levers, chains, and many more mechanical systems, enabling locomotion. There are sound, light, magnetic field and other sensors that help the robot to collect information about its environment. There are processors powered by powerful software that help the robot make sense environmental data captured and tell it what to do next and also microphones, speakers, displays, etc that help the robot interact with humans. There are many different reasons for using a robot such as

A. To save labor and reduce cost.

B. Human is bad for the product for example semiconductor handling. food handling, pharmaceuticals, etc.

C. Product is bad for the human for example radioactive product. And working with machinery that is dangerous for example presses, winders. The other reasons for using robots for example robots can be used to replace human operators where the dangers are repetitive strain syndrome.

D. Quality: While the main reason for using a robot is to save labor the biggest impact a robot has can be on quality. Applications where quality will be improved are gluing, spraying, trimming and de-burring, testing and gauging. assembly and laboratory routines.

Robotics solutions that are well adapted to local conditions of unstructured and unknown environment can greatly improve safety and security of personnel as well as work efficiency, productivity and flexibility. Solving and fulfilling the needs of such tasks presents challenges in robotic mechanics and mobility, sensors and sensor fusion, autonomous or semi autonomous navigation and machine intelligence. Advancement in information and communication technologies along with remote sensing, satellite communication, GPS, and GIS technologies together with the Internet can help a great deal in planning and implementation of hazards reduction measures. Currently, the primary mode for robot communication uses RF. RF is an obvious choice for communication since it allows more information to be transferred at high speed and over long distance.

II. OPERATION

The flowcharts depicting the Robot Movement and its delay are shown in following figures [1], [2] and [3]

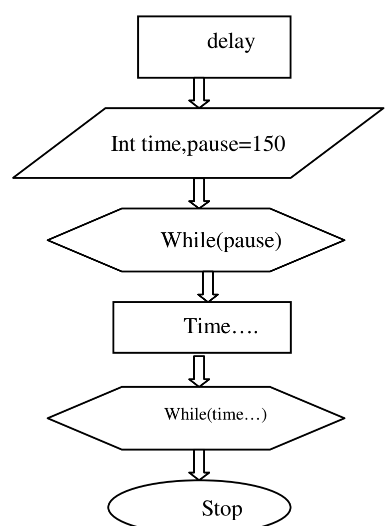

Fig. 1. Flowchart of Delay

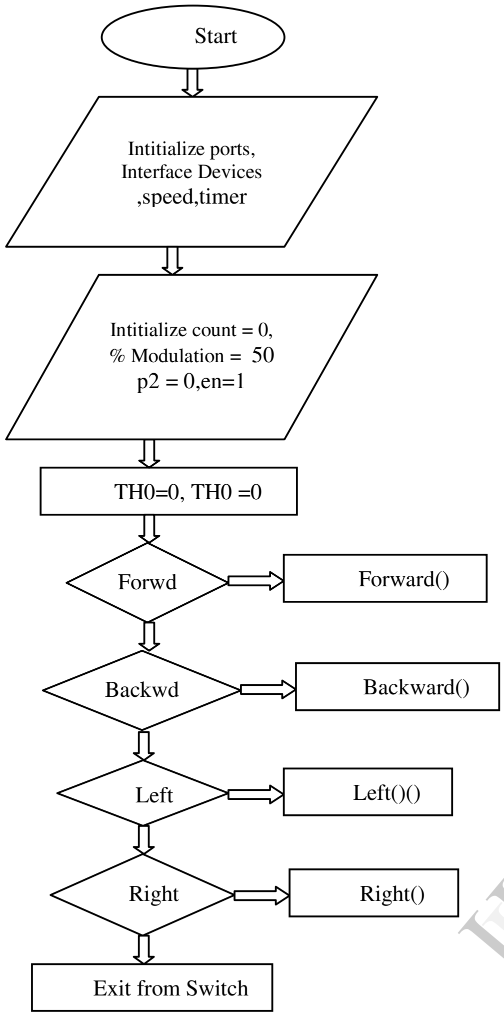

Fig. 2. Flowchart of Robot Movement

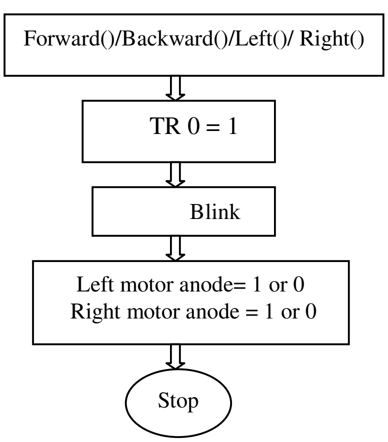

Fig. 3. Flowchart of Particular Movement

III. SURVEILLANCE SYSTEM

A. Robot for Harsh or Dangerous Environment

Intelligent Mobile Robotics Systems begin to emerge in applications related to security and environmental surveillance: prevention of disasters, intervention during disasters with all possible kinds of mission ensuring the safety of the human beings, etc. The application of mobile robots rescue search is actively evolving tools that deal with systems that support first response equipment in disaster missions and risky interventions. Some of these applications may include the use of multiple robots as a team for the purpose to support firemen during firefighting; police during accidents, crimes, rescuing; and disaster agencies with reconnaissance, site evaluation, and human detection, etc.; security agency to support bomb detection and disposal,, chemical and biological agent detection, entering collapsed structures to check and detect survivors, etc.

B. Specifications and Functionalities

There are several key specifications and functional requirements that need to be considered when designing an quality robots

1. The robot should be capable of detecting obstacle, explore its surrounding and reliably navigating collapsed structures. In addition, robots should have the capability to build up reliably maps and localize themselves within the constructed map.
2.It should be operational in multi-modes, such as: remotely teleoperated, semi-autonomous, and autonomous modes,
3.Robots within a team should be heterogeneous supporting different physical functionalities, shapes and sizes, and sensing/detection capabilities
4.Robots should integrate necessary sensors supported by sensor fusion techniques. This enable the robot to gather information about task environment, task itself, structures and victims covered by debris or trapped and be able to determine their state of health as quickly as possible,
5.Robot should be able to detect audio clues and interpret its meaning successfully,
6.Robots should be able to identify, monitor and report any critical and dangerous circumstances,
7.Robots should be protected from waters, chemicals, gases, heat and as relevant to the target application,
8. The developed robot should be compact.
robust and tolerate noise ,Low maintenance, portable and low cost.

C. Techniques used in Surveillance Systems

A typical configuration of processing modules is illustrated in Fig. 4.These modules constitute the low-level building blocks necessary for any distributed surveillance system. It is relatively simple to create constraints in the objects' appearance model by using model-based approaches; e.g. the constraint that people appear upright and in contact with the ground is commonly used in indoor and outdoor applications. The object recognition task then becomes a process of utilizing model-based technique in an attempt to exploit such knowledge. A number of approaches can be applied to classify the new detected objects. The integrated system presented in and can recognize and track vehicle using a defined 3-D model of a vehicle, giving its position in the ground plane and its orientation. It can also recognizant track pedestrians using a prior 2-D model silhouette shape, based on B-spline contours. A common tracking method is to use a filtering mechanism to predict each movement of the recognized object. The filter most commonly used in surveillance systems is the Kalman filter. Fitting bounding boxes or ellipses, which are commonly called 'blobs', to image regions of maximum probability is another tracking approach based on statistical models.

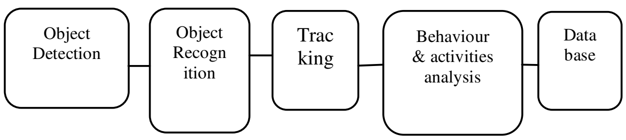

Fig. 4. Traditional flow of processing in visual surveillance system

D. Object Detection

There are two main conventional approaches to object detection: 'temporal difference' and 'background subtraction' The first approach consists in the subtraction of two consecutive frames followed by thresholding. The second technique is based on the subtraction of a background or reference model and the current image followed by a labeling process. After applying one of these approaches, morphological operations are typically applied to reduce the noise of the image difference. The temporal difference technique has good performance in dynamic environments because it is very adaptive, but it has a poor performance on extracting all the relevant object pixels. On the other hand, background subtraction has better performance extracting object information but it is sensitive to dynamic changes in the environment.

E. Object recognition, tracking and performance evaluation

Tracking techniques can be split into two main approaches:2-D models with or without explicit shape models and 3-D models the 3-D geometrical models of a car, a van and a lorry are used to track vehicles on a highway. The model-based approach uses explicit a priori geometrical knowledge of the objects to follow, which in surveillance applications are usually people, vehicles or both.

IV. TYPES

Development of robot for risky environment

Wide range of robots have been developed for different purposes and application domains. Main categories are:
a. Unmanned Aerial Vehicles (UAV)
b. Unmanned Ground Vehicles (UGV)
c. Under Sea Vehicles (USV),
d. Space Robots,
Lets have some highlights on the these:

A. Unmanned Aerial Vehicles (UAV)

Fig. 5. Examples of UAV

Unmanned aerial vehicles (UAVS), also known as drones, are aircraft either controlled by 'pilots' from the ground or increasingly, autonomously following a pre-programmed mission. (While there are dozens of different types of drones, they basically fall into two categories: those that are used for reconnaissance and surveillance purposes and those that are armed with missiles and bombs. The use of drones has grown quickly in recent years because unlike manned aircraft they can stay aloft for many hours. UAV system must comply with rigorous certification and airworthiness procedures, including communications, flight controls and ground stations, they also have to demonstrate safety in relation to loss of communication with air vehicle, resistance to jamming & correct failure-mode recovery; Sense-and-avoid technology will almost certainly be required.

B. Unmanned Ground Vehicles (UGV)

The development and production of inspection and intervention mobile robots, that is those remote controlled unmanned vehicles consist of a mobility platform with sensors, computers, software (including modules for perception, navigation), power system, transmission link and additional equipment – depending on the purpose of the vehicle. The maximum speed is over 16 km/h. With the help of sensors, robot can react unaided to the appearing obstacles, can avoid collision, can independently move in front or behind operator, or at the defined distance from wall. Such a robot can independently execute the task consisting in monitoring of the areas, return to the operator independently. The very essence of the VIEW-FINDER Intelligent Information System is to integrate disparate elements involved in a crisis situation into an info-structure that allows information to be exchanged readily between all of those elements: crisis centers, relevant forces dealing with the crisis (fire fighters, de-bombing squads, police, etc.), robotics platforms and sensors.

Fig. 6. Examples of UGV

C. Under Sea Vehicles (USV)

Fig. 7. Examples of USV

Underwater robots with many degrees of freedom that can walk and swim flexibly in aqueous or water medium are of great interest for underwater monitoring operations including pollution detection, video mapping, exploration of unstructured underwater environments cleaning of ship hull and other bodies like cables and pipes. Current research is performed on real time data collection and on remote control in operation of the drones. Surface robots are an answer to dual applications i.e. Defense and Security like Maritime, Mine-Counter-Measures, Maritime Surveillance, Harbour protection, etc. Current research is focused on sensors integration, energy and autonomy, navigation technologies, communication, command, control and information, systems launch recovery, handling and docking. For better maneuverability and lower energy consumption, biomimetic propulsion is under research and has already proved operability on small UUVs. These alternative propellers mimic swimming motions of fish or marine mammals, and reduce underwater noise. Interesting turbulent fluid flows and fluid-structure interactions occur here. Navigation and communication are a big issue on UUVs, because of the radio non-permeability of water, while USVs may integrate conventional technology for this.

D. Space Robots

Fig. 8. Examples of Space Robots

Space robots have wide and significant range of applications that may include exploration, environmental servicing, assembly, inspection, construction, maintenance, etc. Critical issues that need to be considered when developing space robotics are the type of material and necessary protection, mobility, manipulation capabilities, teleportation, hepatic and time delay considerations.

V. CONCLUSION

The objective of this paper is to review the methods to minimize human casualties in disaster management, surveillance system and war areas. The system should be extensible enough, be based on standard hardware and exploit plug-and-play technology. Mobile robots are increasingly being used to provide automated mapping and surveillance systems. A concurrent trend is the growing interest in Radio Frequency Identification (RFID) technology for access control and object tracking, with a wide range of applications. There has been a rapid growth globally in the acquisition and development of Unmanned Aerial Vehicles (UAVs). The growing demand for safety and security has led to more research in building more efficient and intelligent automated surveillance systems. Therefore, a future challenge is to develop a wide-area distributed multi-sensor surveillance system which has robust, real-time computer algorithms able to perform with minimal manual reconfiguration on variable applications. Such systems should be adaptable enough to adjust automatically and cope with changes in the environment like lighting, scene geometry or scene activity.

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