Situational Awareness Robot

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Abstract— Life is a precious gift from God. Many soldiers and public safety professionals are sacrificing their lives in many situations mainly because of lack of awareness. So an effort is made to reduce the risk of human lives in these situations. The Situational Awareness Robot (SAR) is a tactical mobile robot that gathers situational awareness in dangerous conditions for war fighters and public safety professionals. The situational awareness robot is a portable robot with dexterous manipulator and wearable controller for dismounted mobile operations. SAR enters areas that are inaccessible or too dangerous for people, providing assistance for infantry troops, combat engineers, mobile Explosive Ordnance Disposal (EOD) technicians and other personnel. The SAR gathers situational awareness in dangerous conditions while keeping war fighters and public safety professionals out of harms. This Robot performs dismounted mobile operations. It operates in a variety of conditions and weather. It keeps personnel and civilians at safe stand-off distances. It performs dismounted operations like surveillance or reconnaissance, EOD and route clearance missions. Dexterous manipulation of objects easily climbs stairs and overcomes obstacles. Its rugged design operates in all weather conditions. SAR is light weight and compact. Game style hand controller reduces training time. Modular design accommodates optional payloads and sensors.

Keywords— SAR; tactical; dexterous; dismounted; reconnaissance.

I. INTRODUCTION

In the recent days much attention is paid on safety and health in the work places, like nuclear power plants, war fields, coal mines, following which raised the demand for mobile inspection robots. The safety of human operators in hazardous industrial environment has always been main concern, which resulted in the design of mobile robots for several inspection purposes. Conventional mobile robots are normally large in size depending on the task the machine has to perform. Subsequently, the weight of the robot increases substantially, which results a significant rise on the force needed to make it mobile. Thus the actuators like motors will consume more power, otherwise and the locomotion or the movement of the robot generally becomes slower. Large mobile robots are normally attached to an external power sources like pneumatic, hydraulic or electrical power sources. The proposed design surpasses all these weakness which reduce the efficiency of the robot.

II. PRINCIPLE OF WORKING

The body of the robot will consist of gripper to grip the object, flippers and belts will be helpful for the climbing of the robot. To develop a controller circuit to power and manipulate the motors and solenoid by programming an AT89s52 microcontroller with a program which would achieve the climbing and gripping motions.

This program would be subjective. It would be changed and modified to meet task of manipulating the robot’s position on vertical surface. After the integration of mechanical and electrical parts, the program would be further changed to meet the limitation of the constructed robot’s body. To achieve this robot motion a solid integration between the electrical and mechanical element should be optimized. This means that the electrical circuit would be constructed based on the limitation of the mechanical body. Current research in service robotics focus on single robots able to move, manipulates objects, and transports them to various locations. Our approach differs by taking a collective robotics perspective: different types of small robots perform different tasks and exploit complimentarily by collaborating together we proposed a robot to solve the above tasks: climbing of vertical structures and manipulating objects, to help climbing, it uses side flippers and belts. This robot holds the objects with the help of gripper and provides surveillance with the help of a wireless camera. It detects the dangerous gases and bombs using gas sensor and metal detectors. Climbing, holding of objects and motion of our robot are controlled by wireless hand controller.
We show the design and the implementation of our robot and demonstrate successful by climbing stairs, by holding a bomb.

and rotating valves using gripper, surveillance by wireless camera, detected lpg and metals using gas sensor and metal detector. The main objectives of this work are to

- Create awareness.
- Provide surveillance.
- Reconnaissance.
- Detection and Disposal of Explosives.

III. WORKING PROCEDURE

Five different tasks of the robot viz., motion of the robot, climbing the stairs, picking the objects, detection of gases and metals, night vision are illustrated in this section.

A. Robot Motion

SAR is designed to be able to move forward and backward and it turns left and right depending upon the input command from the hand controller. It has two sensors installed on the chassis, so that it can easily detect the metallic bombs and harmful gases by using metal detector and gas sensor. It has two dc metallic side shaft gear motors with 30rpm to drive the road wheels. So, this can be controlled through the hand controller manually. It has seven digital servo motors out of seven, two servo motors are meant for flippers adjustment and it supports for climbing stairs with 15kg load on each servo. Remaining five digital servo motors are meant for working of robotic arm. Out of five servo motors one is for gripper action. Whenever input command is given to the SAR through the RF module from hand controller, which uses the signal frequency of 434MHz in ISM band. Which acts as a transmitter (hand controller), on the chassis of SAR another RF module is placed which acts as a receiver to receive the signal from the transmitter. But both RF modules can be worked as a transceiver. so, signal received from the RF module on the chassis of SAR is given to the micro controller and it is fed to dc gear motor driverIC(L293D), in case of digital servo motor signal from microcontroller is fed to servo motor driverIC (ULN2803), so as to move the motors accordingly. The reason behind using these motor driver IC’s is the current supplied by micro controller to drive the respective motors is small. Therefore, a motor driver IC’s are used. It provides sufficient current to drive the motors. Now in this case left motor moves in the reverse direction and the right motor moves in the forward direction. So a difference of rotation speed makes it possible to make turns. In case of servo motors depending upon the time period of duty cycle of the pulse which is fed to servo motor and it will rotate in possible direction.

Stair Climbing Here the main reason behind using the side flippers is to lift the chassis to climb the stairs by using digital servo motors at the front side of SAR to provide a vertical lift force. Then with the help of side flippers robot will climb the stairs etc. Whenever non-uniform areas are present robot uses the side flippers to overcome the constraints of those areas, and then motion of SAR will continue by adjusting the side flippers properly.

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C. Picking the Objects

SAR gives the information regarding a situation through wireless camera which is operating in ISM band. So, that signal from wireless camera is received by hand controller through RF module then the picture will displayed on LCD screen which is in the hand controller. Then by understanding the situation SAR will pick the object with the help of gripper using digital servo motor in the robotic arm. So, robotic arm will play a major role in picking up the object and controlling the controls in the nuclear power plants etc. It will dispatch the bombs and detects the harmful gases by using metal detector and gas sensor.

D. Detection of Gases and Metals

By using gas sensor, it can detect the harmful gases in mines, wars, industries etc. Whenever a harmful gas is present it will detects by adjusting the sensitivity of the gas sensor, then by indicating the LED. Gas sensors are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, iso-butane, propane, LNG, avoid the noise of alcohol and cooking fumes and cigarette smoke. Resistance value of MQ-6 is difference to various kinds and various concentration gases. So, when using these components, sensitivity adjustment is very necessary. We recommend that you calibrate the detector for 1000ppm of LPG concentration in air and use value of Load resistance ( Rl) about 20KΩ (10K Ω to 47K Ω). When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

SAR will detect the metallic bombs and dispatches by using metal detector. This circuit detect metal and also magnets. When a magnet is brought close to the 10mH choke, the output frequency changes. This metal detector project can be powered from a power supply that can provide an output DC voltage between 6 and 12 volt. If a metal is closer to the L1 coil, it will produce a change of output oscillation frequency, that will generate a sound in the speaker. Whenever it detects the metallic bombs in the war fields and it dispatch if necessary and it can throw away by using robotic arm.

E. Night Vision

With the use of IR LED’s we can operate the SAR in the dark nights.
IV. RESULTS

Fig. 1 to Fig. 4 shows the output of our research work.

Figure 1. Picking up the object

Figure 2. Bomb disposal

Figure 3. Controlling the controls in nuclear power plants

Figure 4. Stair climbing

V. CONCLUSION

An implementation using mainly servo motors, gear motors, grippers, flippers and a new algorithm to enhance the accuracy of operation process, object pick-up process and its successful experimental results are presented. As robotics have provided great impact and utility based on it this project will introduce robotics into the nuclear power plants and military. The technology being developed will allow a robot to travel long smooth distances with significantly less energy than a tracked vehicle, while maintaining the ability to climb difficult terrain like stairs and rubble.

REFERENCES


