Interpretation Performance of Sedra's Rescuer Robot and Optimize the Physical Form of the Robot

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Abstract
Earthquakes, fires, explosions and other natural and abnormal accidents cause debris and destruction of a site, after which the aid and rescue teams should help people who are in this area. Sometimes relief is inaccessible in some places. The environment that fires it and makes it difficult for the aid workers to make it difficult to make it difficult. Hence, aid robots come to the aid of the relief team to help reach the victims of the accident. Robots with an anti-fire and high-power body can be traversed as stairs and cross the obstacles to reach the accident points and send a picture of that area to the control unit. After seeing the images of the injured, the officers can make a decision on helping the area. So far, there have been many rescuer robots, the Sedra rescue boat known as a national rescue robot designed and built by the robotics team of the Sharif University of Technology. Despite its various features, the robot has many disadvantages, including weight and volume. In this dissertation, measures are taken to address the disadvantages of this robot. In the chapters of this thesis, after analyzing the Sedra's robot's robot, the rotary wheel is used instead of the rubber wheel's rubber technology. These changes reduce the weight and volume of the robot and improve the performance of this robot.

Keywords:
Chainsaw – Rescuer – Robot – Sedra

1. Introduction

Today robots have come to the aid of humans in most difficult and difficult tasks [1]. Robots can be designed to work in different physical conditions. For example, a robot controlling acid ponds that can act on acid basins and cause acid vapor to not enter the robot [2]. Or cargo bots that can carry several hundred tons. Rescuer robots are also used to help badly damaged areas suffered from earthquakes, floods, fires, or war crimes. Rescue workers' robots can join the rescue team and identify the injured and inform the team when the work environment has debris or fire-induced heat from the rescue team's progress. [3] .
The Sedra's rescuer robot, designed and built in 2006 by the Robotics Research Team of the Sharif University of Technology, is an optimal robot in terms of physical form and performance in rescue. The robot has won second place in the World Robocop's in 2002. The robot with its own 30 kilograms of weight, which has 10 engines and 6 tires, occupies a volume of about 2 cubic meters [4]. Hence, in this thesis, the number of engines and rubber wheels and the weight and volume of this robot are optimized, and given the minimum number of engines and rubber wheels, with this control technology, the new Sedra relief robot will be provided.
Subsequently, the work of the Sedra Rescuer Robot will be dealt with and the paper presented by the researcher team for the design of the robot in 2005 will be examined. Then, considering the technologies that have been provided to the rescue robot so far, an appropriate hardware technology is considered for robot movement, and in the design phase of the robot, a proposal to use other equipment to reduce weight and volume And the number of Sedra rescue robot engine drivers. The new robot design has been attempting to keep Sedra's software technology intact, and it will work with the same back-up technology. Because the previous technology has been able to win the second place in the world.

2. Sedra Rescuer Bot:

In 2005, the scientific, design, robotics and automation center of Sharif University of Technology, under the guidance of a professor, began the construction project for the construction of a sailboat rescue robot [5, 6]. The goal of this project is to build an intelligent robot for use in relief operations. In relief operations, in addition to having a rescuer taking into account the physical conditions of the environment, it may not be able to properly utilize all of its capabilities, while at the same time searching for the injured, it is subject to various dangers [7]. Therefore, the use of a robot to find the injured person as well as finding the appropriate route for the victim's assistance to the injured person not only reduces the risk to the rescuer, but also increases the accuracy and speed of the relief team [8]. One of the major problems in designing and constructing relief robots is the irregularity, instability and unpredictability of the robot's work environment [9]. Therefore, achieving a high-reliability control system and building a high-flexibility mechanical system with the environment is one of the most important characteristics of a rescue robot. In addition, the identification of the injured person by human features such as skin color and skin texture, or vital signs such as movement of body parts, body

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temperature, or sound of the injured, is another specific feature of these robots [10, 11].
In this regard, the scientific design, robotics, and automation of Sedra have made various robots, one of the most successful examples of which is the "Sedra Rescuer", which uses the improved MIG-mechanism. This robot is of a rolled type and has a special ability compared to other wheeled robots [12].
In the ranking of mobile robots, one of the important factors is the active or inactive of the motor system. Inactive passive system is based on a passive suspension system in which there is no additional sensor or operator to guarantee a steady movement. On the other hand, an active robot affects a closed-loop control loop that maintains system stability while moving [13, 14].
It is clear that the active motor system expands the ability of the robot, but at the same time it raises the complexity and requires extensive control resources. However, with the actual speed of controllers, the creation of an active motor system is one of the goals of many of today's research [15].
The key criteria for space automation robots are energy consumption, reliability and motor capability. The complexity of the active robots and the rising weakness of the inactive robots, the team encouraged researchers to research on the new concepts of the motor system in the inactive rovers. Further, various types of motor mechanisms may be introduced.
Moving machines (Bares and Wettergreen, 1997) are ideally suited to aggressive environments, and this is due to their ability to ensure sustainability in a wide range of situations. At the same time, these robots have complex mechanisms and their control is difficult. On the other hand, they have a slowdown speed and high energy consumption [16].
Because of the stability and proper friction coefficient, the sand motion mechanism has a good movement in rugged paths. Its mechanism is simple, but its energy dissipation is relatively high. It also has no ability to adapt inactive to many uneven surfaces [17].
Wheeled robots are ideal tools for surfing smoothly or with mild roughness, but in rugged environments, the mobility of these robots is heavily dependent on the type of roughness, the shape and size of the robot mechanism, and the size of the barriers. Decrease or increase. Among the robotic robots made for uneven paths, it can be noted that Sojourner, Rocky-7 [15] or Micro-5 [16], who are typically able to overcome the obstacles to their wheels. . Adding the ability to climb obstacles to a wheeled robot requires the use of special strategies and sometimes the use of additional operators. For example, Marceaux [8] and Hyptor [9]. In some cases, complex control processes such as the Nano rover robot are also used.
In general, wheeled robots have more adaptability and stability than robots, and in addition to less complexity, they have much higher yields. The main problem of these robots is the lack of lifting capacity and transit barriers. To overcome this defect, with the advent of roll-on robots, it has been attempted to some extent by removing the wheel's axis to the body.
The MIG-shaped Robot built on this basis, using a four-rod shaft arm, side wheels with parallel levers and a flexible shaft, has a great ability to move in areas with irregular obstacles. Also, the use of speed-controlled wheels and steering angle adjustment on the front and rear wheels of the robot give the robot the ability to maneuver high precision. On the other hand, due to the fact that on each wheel of this six-wheel robot, a motor is installed, all torque weights can be used to apply torque by motors. In fact, the robot is comparable to that of a six-wheel drive car, which can, in adverse conditions, focus its efforts on pulling power barriers on different wheels.
Due to the robot's hardware capabilities, this robot can be used with software-only changes for military applications such as robot mine smith, robot soldier or robot.
The robot with a length of 80 cm and a width of 45 cm at a height of 60 cm, with a mass of 30 kg, has 10 DC motors capable of delivering a speed of 1800 m / h.

3. Proposed Robot:

The robot uses two wheel chains to move. The axles that carry the power transmission to these chain wheels are mounted on each one individually. The axes of this robot must be parallel. Figure 1 shows how to position the motors of the Sedra's robot.

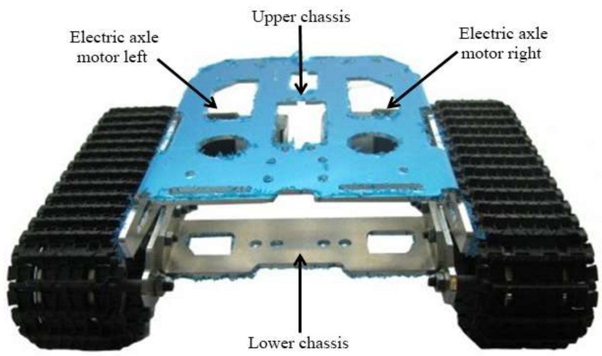

Figure 1. The position of the electric motors on the robot's motor axes

In Figure 1, the chassis of the robot have been identified that include the upper and lower chassis of the robot. The lower chassis has the task of maintaining a robot's balance when crossing obstacles such as stairs. If one of the robot axes is on a surface not aligned with another axis at a height, this page will keep the robot equilibrium and move the lower axle pressure to the lower axis. This makes the lower axis tolerate the centrifugal force and thus the robot can pass through different gradients. This slope can be up to 45 degrees. That is, if the high axis is located at a 45-degree slope toward the low elevation, it will eliminate the probability of a robot's overturning, but if this slope is increased, the probability of a robot's overturning is also increased. Obviously, the longer the two-axis distance, the more it is at a higher elevation of 45 degrees. For example, if the distance between the two axes of the robot is 15 cm, the difference in height can be up to 10.6 cm, if this distance is increased to 30 cm, the robot can move up to a height of 21.2 cm. According to the equation of the sinus, the opposite side to the adjacent side, we can consider equation (1) to calculate the distance between two axes.

$$altitude = sin(45^{\circ}) * Distance$$

Equation (1). Calculate the desired optimal distance between two robot axes

In this equation, the altitude component determines the maximum difference between the two axis height, which is a multiple of the sinus 45 degrees and the distance between the two axes. The distance component is the distance between the two axes of the robot. Of course, according to this equation, the wider the robot (the distance between the two axes is greater), the difference in the height of the two axes also increases.

The upper chassis of the robot is used to keep the robot running. Other components of the robot include batteries, cameras, and robot control sensors. This robot needs two electric motors to move. Each of the axes has an electric motor. These engines are ordered separately from the control center. The motor technology of the two engines is the same as the wing of the plane. If both engines move with the same force to the right, the robot moves forward and moves in a straight line. Against this, the robot stands out if both engines do not transmit any force to the axes. But if one of the engines adds more power to the axes than the other engine, the robot moves to the right or left. So steering the robot is through the transfer of power to these two electric motors. The electric motors that are used in the Sedra axis are powered by 24 volts of DC power and output 40 watts.

As mentioned in the third chapter, the Sandra rescue robot filmed its environment and sent it to the central computer. The movie must be captured by an infrared camera that is capable of filming in dark and dark environments. The camera on the Sedra's robot has the capability of filming in any kind of environment, which uses the same camera in this robot. The camera is FPV 700TVL branded by Sony, which has 10 grams of weight. The camera delivers 61 million pixel images that are arranged in 1020 columns and 596 rows. The lens is 2.2 megapixels and can be set to 7V and can be set to HD movies [18, 19].

4. New robot specifications:

The chassis of the new robot is 20 cm long and 15 cm wide. The chassis height is 7 centimeters, which increases the height of the robot by 20 centimeters based on the location of the camcorder at the highest point of the robot. The chassis of the robot weighs in at 470 grams, with an estimated weight of about 1,000 grams, including a battery (500 grams), a camcorder with a base (20 grams), a control board (40 grams) To be

With changes in Sedra robot technology, the length of the robot changed from 80 cm to 20 cm, the width changed from 45 cm to 15 cm, and changed from 60 cm to 20 cm. The weight of the robot was 30 kg. The robot, which has less weight and volume than the previous cedar robot, has the ability to move under some of the barriers. Also, this low-weight robot brings the least damage to the environment. Table 1 shows the characteristics of the new Cedar robot.

Table 1:. Specifications of the new Cedar Robot

Long	20 CM
Wide	15 CM
Height	20 CM
Total mass	1100 grams
Speed	1400 m/h
Wheel diameter	7 CM
No. of motors	3 DC motor
Max operating time in horizontally	3 hours
Enormous force	280 Nm
Body height from the ground	7 CM
Radius of telecommunication	50 M
Battery weight	500 grams
Operating voltage of the driver	24 V
Operating voltage IPC	5, 12 V
Type of wheel controller	Speed control
Type of controller	Position control
Working frequency	25 KHz
Type of driver	Full bridge 4 quadrant DC/DC-PWM Converter
Type of Battery	NIMH Rechargeable

Based on the changes that were made in the hardware form of the San Diego's rescue robot, changes to the robot's application also occurred. The Sedra's rescuer robot, built by the robotics team at Sharif University of Technology, won the second rank at the World Robocop World Cup, with a weight of over 30kg and a volume of over 2 cubic meters. Of course, the place damaged by fire or earthquakes does not have the space to pass the robot to such an extent. The weight of the robot also increases the power consumption of the robot. On the other hand, Sandra Gauss's robot sometimes passes through rubble, which may be the victims underneath the debris. The injured person's body is less sensitive to weight. Now, if a robot with a weight of 30 kilograms passes through an injury, it may lead to irreparable damage to the injured body.

Sandra's rescue boat, despite having 6 rubbers wheels to move, easily passes barriers and stairs and can easily prevent overturning. The chance of success of this robot is that it can pass through any platform and step without causing a motor problem. But the robot needs 6 electric motors for six wheels, each engine that needs a battery to power the electrical energy. Finally, considering the robot's advantage in terms of energy consumption and robot weight, it is possible to decide that this feature is not cost-effective, and it fails to increase the weight of the robot. As mentioned, the Sedra robot can easily pass through any platform and step. Maybe this robot will consider the debris poured on the floor as a platform or stairs. At first glance, it's very useful that the robot can pass through the rubble and reach its hotspots. But with an inward look at this issue, which may be traumatic under the rubble, this property can be ruled out. Because the movement from the rubble on the casualties causes more damage to the injured people.

Sedra's software technology is also not very efficient. This robot is connected to the robot by connecting the wiring harness to the robot. Certainly there are a lot of electrical noise in damaged environments in terms of earthquakes or fires. So the use of wireless technology to connect the robot to the control handle is wrong. Because wireless signals show a high sensitivity to electrical noise. On the other hand, wired connections also eliminate the noise to some extent. So noise on wired connections also causes problems. The connected wire between the handle and the Sedra robot should be strong type of noise isolator. This wire is made of copper, a double layer aluminum foil. In this connection, very strong noises can enter the wire, and the rest of the noise will not have the chance to enter the communication link. However, there may be errors in this type of connection. If intelligent routing technology was used instead of the robot taking control of the handle and tracking its tracks and filming the damaged environment through a wired connection to the control center, these problems would also be eliminated. Went away In this technology, robot intelligent routing algorithms capture all parts of the affected area and store it in its internal memory. The information then passed to the control center when it left the affected environment. This method does not require manual control of the robot and the robot detects its path. Therefore, there is no need for wired or wired connection and many robot software problems are fixed. The Sedra's robot is designed manually by the team of robotics at Sharif University of Technology, and the connection between the controller and the robot is wired. In this thesis, the same software technology has been used without interference in the nature of this robot, and the only suggestion to improve the performance of the robot is raised in this regard.

Another benefit of the success of the Sedra rescue robot is the improved imaging by the robot. The Sedra rescue robot uses Panasonic's infrared night vision camera. The camera has imaging capability in dusty environments and dust. These cameras typically capture images at a time when they see their surroundings and display the image clearly. But if the environment is dark or dusty, turning on its infrared lights can capture imaging in an infected and dark environment and continue with imaging requirements. This technology is now embedded in all cameras. Simple CCTV cameras and even advanced camcorders use this technology. So, the Sedra's rescue robot has no problems with imaging the affected environment. For this reason, the thesis uses the same imaging technology.

To the extent possible, this dissertation attempts to resolve the disadvantages of the Sedra's robot. The advantages of this robot are also used as much as possible. The changes that have been made to the catastrophic Sedra robot to cover the disadvantages of this robot are mentioned in the following terms.

The Sedra's rescue boat was massive because of the use of six rubber wheels and each wheel individually equipped with an electric motor and battery for feeding electrical energy. In this thesis, the weight of the robot was reduced to the extent possible by using chain wheels and using two electric motors to move the axis of the robot. So that the robot weighed about a kilo in weight to a kilogram. Now, if a robot with a weight of one kilogram passes through the injured person's body, there is not much damage to that body.

5. Conclusion

The use of 10 electric motors to boot the robot and control the imaging camera and other robot equipment will increase the size of the robot. The robot occupies about 216.0 cubic meters of space. However, in this dissertation, the San Diego's robot needs 0.066 cubic feet of space. That means the robot is 36 times smaller in volume capacity.

Figure 2: Volumetric proportions of the Sedra rescuer robot after and before physical changes

Based on this weight loss and volume in the Sedra's aid robot, it can now be said that the robot can search underneath many debris and will not bring any injuries or injuries to injured people. The Sedra rescuer robot, corrected in this thesis, can perform relief operations with the least amount of electrical energy. It is hoped that in the future, robot control technology experts will also be reviewed to make the national robot known as the best rescue robot.

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