Kavosh Team Description Paper

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Abstract. The Kavosh team has chosen working on rescue robot as its technical activity in the club in order to fulfill the needs of Iran to mechanized rescuing systems.

In the field of rescue robots, implementing a robot with good maneuver, safe systems, victim detector sensors and a software which is user friendly and decision aid are some important points that are worth of attention.

Kavosh robot in addition to these points by representing some features like watchtower, revolving arm, and positioning systems consisting vision and audio, has taken his steps in this field.

1 Introduction

According to official statistics published by IGU (International Geographic Union) Iran, like other Asian countries, is on the earthquake belt and this causes a lot of damages and injuries every year. For example the earthquake, which happened in Roodbar-Manjil in Iran caused the death and injury of thousands of people and also every year Iran faces many other unforeseen accidents such as flood and these events lead to many injuries to the victims.

The Javan Robotics Club decided to create the rescue robot in order to investigate and work on Rescue Robot for this goal:

Decreasing the damages and increasing the rate of rescuing victims, which are caught under the desolations, and besides, take part in the Rescue Robot competition.

The activities of this club, that is the first Robotics Club in Iran, started from 8 months ago. The Rescue Robot team started its studies on Rescue Robots from the beginning of the foundation of the club and after finishing their researches they started to construct this robot.

2 Mechanic

According to the filed condition there are two special properties in this robot that will be introduced in this part.

Because the filed is uneven and there are obstacles such as stairs and ramp in the field, caterpillar treads has been selected for the movement system of this robot. This system contains two separate gearbox motors that give the robot the ability to move on a straight line or curve and also turn around itself.

Because finding victims is the main task of the robot, it should have a good vision. Because of this, four cameras are placed on the robot; one of which has pan-tilt-zoom (PTZ). In order to have an image from all parts of the field, this camera is placed on a watchtower that elevates it up to 2.15 meters. This watchtower has some properties such as strength, lightweight and easy movements. By this we can have a wide view from the field. And by using zoom we can see the details of any object in the field. Figure.1 shows the watchtower.

Regarding the field conditions, the robot may turn over. In order to continue the competition the robot has a "Revolving Arm" that can turn up to 360° around the robot. The interesting point is that the revolving Arm can be used for opening the hinged and sliding doors. Figure.2 shows the arm.

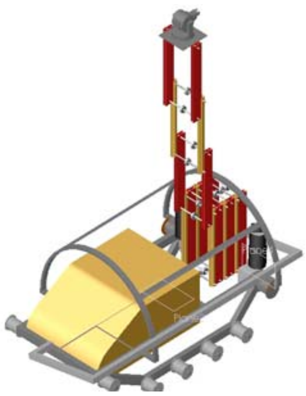

Figure.1. Watchtower

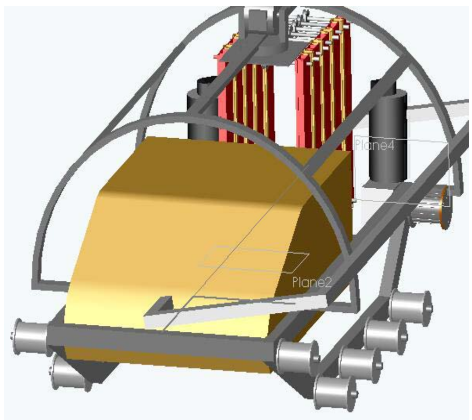

Figure.2. The Rotating Arm

3 Electronic & Hardware

There are several sensors on the robot in order to simulate the conditions of the field for the operator.

There will be four cameras on the robot. Two of them are fixed on the robot for stereovision positioning and the rest are placed on the watchtower and Pan-Tilt. One of the last two has motorized zoom and the other is IR camera. Each of these cameras transmits its frames by a UHF sender to the host. These frames can be shown on a single TV simultaneously. The operator can set the direction and the angle of the Pan-Tilt, which is on the watchtower. The two fixed cameras are used to determine the distance between the victims and the robot by stereovision system. There are some microphones on the robot that are used to transmit the sound of the field -as an important parameter for finding the victims- to the operator. Right now we are working on defining the direction of the victims' sounds by processing these data's.

There are wireless LAN cards placed in the robot and in the host computer for transferring the data's between them. These data's contain commands such as running the motors, turning the PTZ, switching the lamps and etc. There are some data's that must be sent from the robot to the host such as the voltage of batteries, the encoders output, and sounds.

There is also an emergency data transferring system between the host and the robot. This system consists of a UHF transceiver. The operator can choose any of the two communication systems.

Figure 3 describes the block diagram of the hardware and electronic system.

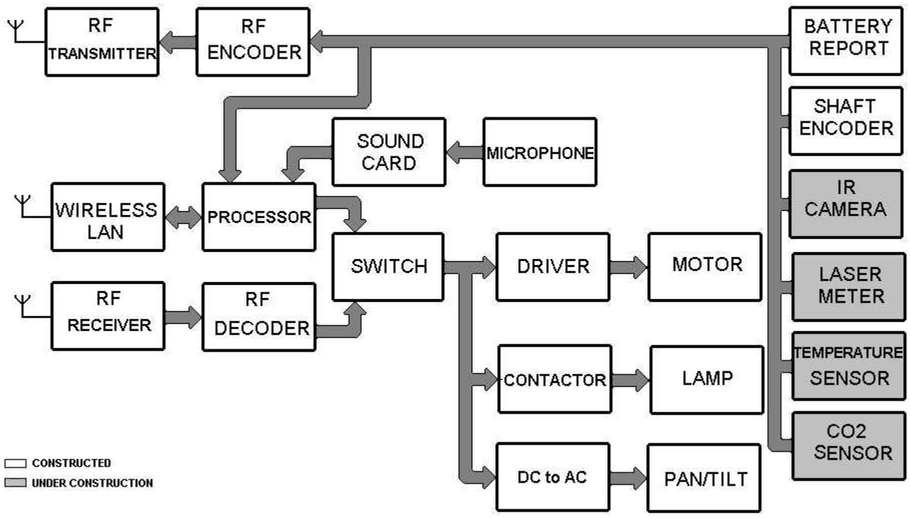

Figure.4. Block diagram of Electronics & Hardware

4 Software

As far as we have two computers, one in the robot and one out of the field, we can classify the software into two sections, host and robot software.

Host, the section which is installed on the external computer, has the duty of processing and displaying received data's from the robot and sending the control commands from the operator to the robot. User-friendly design and the way of representing the information in this software enables us to reduce the affect of operator's mistakes in processing the data's this software also helps us by suggesting the most reliable and applicable choices. In robot emergency situations the software warns the operator by displaying warning messages and alarms. Moreover the software is able to prepare an accurate map of found victims.

In emergency situations we may loose the processing ability of the robot and for this we have reduced the processes made in the robot. The robot software transmits the data's from the robot to the host and vise versa. It can also produce control commands for an interface that controls each part.

Reliability and safety of Linux operating system, led us to choose one optimized version of Linux for the robot.

From another sight of view we can categorize the whole software in to three parts: positioning, user interface and communication.

Positioning and interface software modules are installed on the host computer and the communication module is in both host and robot computer. Receiving the signals of the joystick (which is the steer of the robot), sending them by the wireless LAN or RF, gathering the data's of sensor and sending them to the host is held on the robot.

Sound positioning and stereovision are the techniques that are used for positioning.

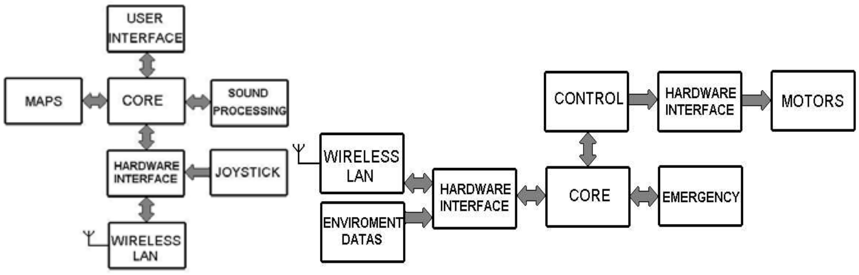

Figure.3. Block diagrams of Software group

5 Conclusion & Future work

The elementary implementing of the robot systems had some enthusiastic points and has interested the team members in developing the Kavosh robot. As the communication system, host, the hardware and software architecture of the robot are expandable and scalable, we intend to work on multi-agent rescue robots for this year and next coming years. Such that Kavosh robot will be the main robot and some simpler robots play the roll of detecting. More serious works such as positioning with laser; half automatic processing of the pictures of IR camera and defining of the voice direction are some activities, which are the later goals.

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