Human Rescue Robot

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ABSTRACT

This paper dealt with the on-task adaptive design of the human rescue robot based on the human rescue scenario. According to the scenario, still, conventional methods (human and trained dogs) are being used to find and rescue the victims who are buried under the rubble after natural or man-made destruction. Such operation is very dangerous for the rescue workers and victims as well. Many areas of the world are getting affected due to sudden natural calamities like earthquakes, wild-fires, storms, etc. These traditional methods increase the chances of causalities due to their risky and time taking approaches. Hence, to make the rescue operation safer and effective, we have proposed a Human Rescue Robot which detect alive human beings trapped inside the debris. This robot provides the momentous help and safety to the rescue workers during the search and rescue operations. So the proposed system uses a raspberry pi 3 B+, web camera, led which helps to detect a human in dark areas, power sources, buzzer, and DC motors.

Keyword : - *Human, rescue, robot, natural calamities, raspberry pi 3B+.*

1. INTRODUCTION

In case of emergencies usually, the search operation is carried out manually this is very time-consuming. In Karnataka's Dharwad building collapse, it took 4 days to rescue 62 people trapped inside the debris. After wall collapse in Malad, Mumbai, it took 15 hours to rescue a 14-year-old girl and she died soon after reaching the hospital. During a crisis like the collapse of a building, the most important thing is to make sure that there is maximum number of survivors. This can be made sure by rescuing as many people as possible from the debris left after the collapse. Rescuing people from the debris is the toughest problem that the rescue team face. While rescuing people the rescue team put themselves in danger, as after going inside the debris they might also get trapped. A problem is that the rescue team doesn't know where the survivors are trapped inside the debris. To locate them is a great challenge for them. Finding people manually is also a time-consuming process, which can be fatal for the survivors trapped. With such problems, if there is a human proxy that can find the survivors inside the debris so that the rescue team can get to the survivor and rescue them easily.

2. RELATED WORK

We have studied different technologies and had gone through several blogs indicating different approaches taken by the expert/author of the blog to solve/ implement the project idea in their own unique manner.

We have first overviewed the different existing approaches towards human victim detection. In the scope of this research project, the detection of human body shapes from visual input data was chosen as a recognition method, a decision mainly due to the available sensor equipment on board of the victim detection robot. Based upon the Viola-Jones (face) detector, this was adapted, such that human victims lying on the ground can be detected. The first results of this approach are encouraging, but future research is required to increase the detection rate and reduce the number of false positives. This will be done by integrating the human victim detector in a tracking scheme. A mobile robot equipped with such a human victim sensing system can be a valuable aid for human crisis managers, as it could scan a designated area for human survivors semi-automatically. If there is no possibility of the internet then the whole system will stop working. Many people have died by being trapped under the debris as their presence cannot be detected detect by the rescue team. Sometimes, it is impossible to reach in certain points of the disasters in such calamity hit zones. The situation is worst for developing countries like Bangladesh because of low-quality design and construction. The PIR sensor based semi-autonomous mobile rescues robot is developed which can detect live human beings from an unreachable point of the disaster area. IP Camera is also integrated to observe and analyze conditions that will facilitate human detection in a reliable manner with the highest probability of success rate in that kind of situation. The developed robot is joystick control which will facilitate user to drive the system easily. RF module is used for data transfer to make the system reliable inside the disaster area. Quince mobile robot has four dynamically adjustable wheels, IR sensor and CO2 sensors to detect humans under rubble. Most search and rescue robots spot the victim with the help of the PIR (passive infrared) sensor. Passive IR sensor senses variations in the quantity of IR radiation striking on the sensor, these changes in radiation from time to time depending upon the temperature of the entities present before the sensor. When an object, like a human, walks in front of the sensor, the temperature in the sensor's field of view will make upswing suddenly to body temperature from room temperature. The sensor translates the alteration in the received IR radiation into an output voltage to determine the presence of a human. PIR sensor has some limitations, for example, it cannot detect a motionless or sluggishly passing body. Most of the time, the victim remains still and could not move due to debris fell upon him. Therefore, the use of the PIR sensor is not as effective in the given scenario. All the above-discussed drawbacks of the existing system urged us to propose such a system that could overcome these limitations.

3. PROPOSED SYSTEM

Our proposed system solves the problems possessed by previous systems effectively and efficiently. Our proposed robot uses a completely new sensing mechanism to detect alive victims during search and rescue operations. To detect the presence of living human we are using raspberry pi 3B+ as a base computing platform that can handle many components simultaneously. HRR skeleton is designed in a way that it can work in rough terrains and rocky surface. We equipped a camera for video surveillance and monitoring scenario that can be controlled through GUI. The camera provides HD real-time stream to the user which could be recorded to analyze the scenarios more closely. This video streaming is used for controlling the manual navigation of the robot in the prone area effectively. The robotic payload-carrying base support platform and legs are made of Un-Plasticized Poly Vinyl Chloride (UPVC) pipes. Rubber coated wheels are coupled with motor and clamps are used to tighten it with UPVC legs. User Interface consists of the camera screen i.e. the view the camera the robot is having and the UI also consists of the controller which has 4 directional buttons and one button for light control. The UI also has a message display box at the bottom of the screen that displays the number of survivors found. The system is totally platform-independent. The system can run on any OS i.e. Windows, Linux, Mac OS. The system is totally user-friendly. Any specific training is not required to access the system. The user should know the basic knowledge of computing to use the system.

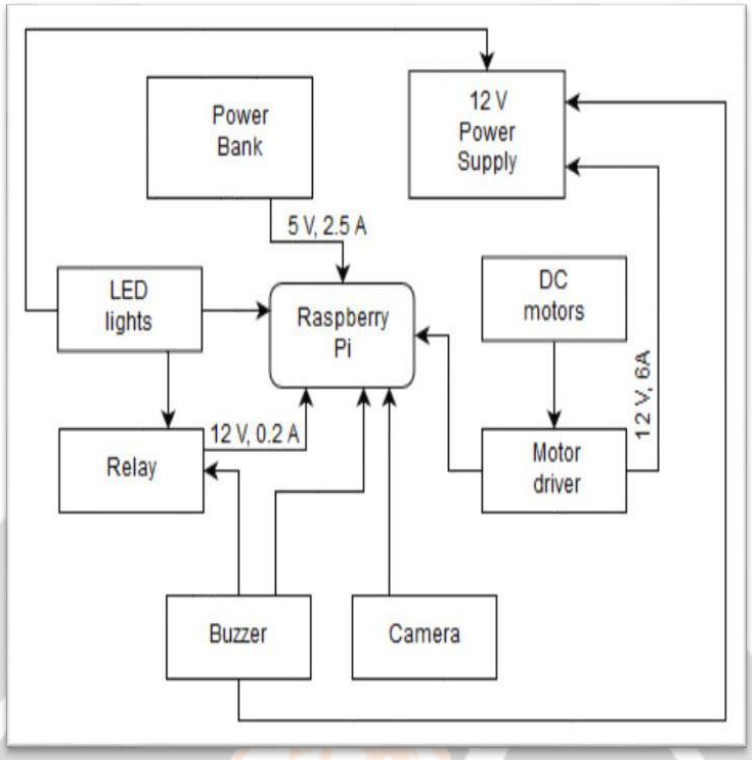

Fig 1. Block diagram

Fig1. Refers to human rescue robot computing platform where the central processing is done with the support of raspberry pi and power to the raspberry pi is given from a 5V, 2.5A power bank. The other component supporting the features of the robots are connected to the raspberry pi such as LED, camera, Motor driver for DC motors, relay and buzzer and the whole system is powered by 12V rechargeable battery

Fig 2. Robotic leg when assembled with wheels

Fig 3. Prototype

4. IMPLEMENTATION

When we power up the robot, it waits for an admin or operator to connect with it. There is a button in the control application; the user can connect with the robot by clicking the button. The LED will start glowing if there is darkness affected area. The buzzer will start beeping if any victim is detected. In the event of loss of signal between the robot and the base station, the robot will stop working. The autonomous mode will guide the robot to carry out the rescue operation for a particular time period and more to a place of adequate signal strength then transmit the recorded information. The system will be providing the notification service in the situation on the detection of the human a message "survivor found" will be displayed on the screen along with the number of people detected. The admin can control the robot with a control application bypassing instruction to the robot and can take the appropriate decision.

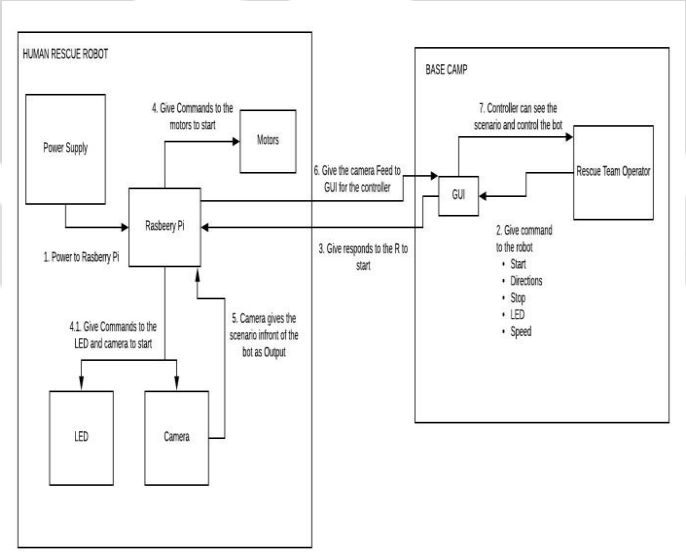

Fig 4. Collaboration diagram

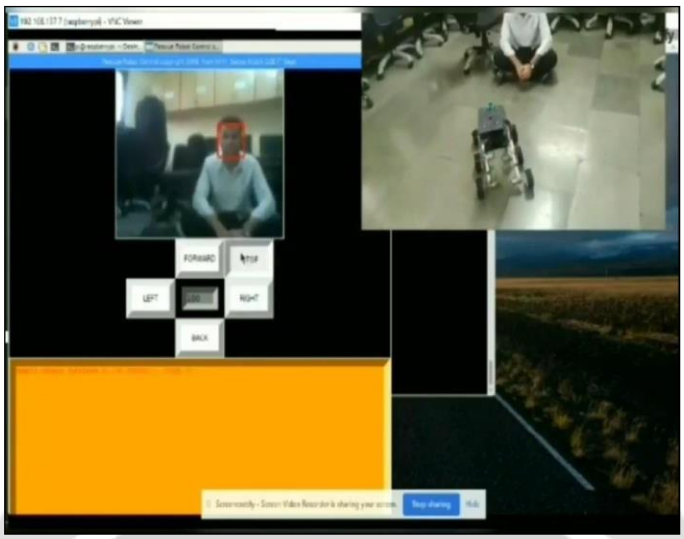

Fig 5. User Interface

Fig 6. Operation area

5. TECHNOLOGY

- **Python:** Since we are using Raspberry Pi, the programming language that we are using is python3. The camera and survivor detection code are done using python.
- **Open CV2:** This is a library that we have used for face detection.
- **Tkinter:** It's a standard Python module used to develop GUI.

6. CONCLUSIONS

We have first overviewed the different existing approaches towards human detection (victims). In the scope of this research project, the detection of humans is carried out with the help of a web camera. The first results of this approach are encouraging, but future research is required to increase the detection rate and reduce the number of

false positives. This will be done by using machine learning algorithms and integrating the co2 gas sensor to detect humans.
A robot equipped with such a human victim sensing system can be a valuable aid for humans.

7. REFERENCES

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