ANOTOMOUS ROBOT

B.S.Raghuram krishna[1], kusuma venkata ramani[2], Y.Sairatan[3],R.B.Rithishvikram[4], Mrs.Vijayalakshmi[5],

[1] *B.Tech student, Department of CSE, SRMIST, ramapuram,chennai*
[2]*B.Tech student, Department of CSE, SRMIST, ramapuram, Chennai*
[3]*B.Tech student, Department of CSE, SRMIST, ramapuram, chennai*
[4]*B.Tech student, Department of CSE, SRMIST, ramapuram, chennai*
[5]*Faculty of engineering, Department of CSE, SRMIST, ramapuram, chennai*

ABSTRACT

The purpose of this paper is to present a survey of general robotic systems and performance analysis. This paper will also present ideas and research from three related fields within robotics: assistive robotics, human robot interaction, and autonomous robotics. In each of these cases the information provided is intended to help with future research by providing the taxonomy and concepts of that field. The most important idea this paper tries to convey is to be aware of all aspects of a system before studying, and to avoid analysis errors resulting from tunnel vision.

Keywords: *Robotics, Human Robot Interaction, Assistive Robotics, Real-time robotic systems, multi-robot systems, Unmanned Aerial Vehicle, Autonomous Robotics, Performance Analysis, Metrics, Modeling, Simulation, Benchmarking.*

1.INTRODUCTION

An autonomous robot performs behaviors or tasks with a high degree of autonomy, which is particularly desirable in fields such as spaceflight, household maintenance (such as cleaning), waste water treatment and delivering goods and services.

Some modern factory robots are "autonomous" within the strict confines of their direct environment. It may not be that every degree of freedom exists in their surrounding environment, but the factory robot's workplace is challenging and can often contain chaotic, unpredicted variables. The exact orientation and position of the next object of work and (in the more advanced factories) even the type of object and the required task must be determined. This can vary unpredictably (at least from the robot's point of view).

One important area of robotics research is to enable the robot to cope with its environment whether this be on land, underwater, in the air, underground, or in space.

A fully autonomous robot can

- Gain information about the environment
- Work for an extended period without human intervention
- Move either all or part of itself throughout its operating environment without human assistance
- Avoid situations that are harmful to people, property, or itself unless those are part of its design specifications

An autonomous robot may also learn or gain new knowledge like adjusting for new methods of accomplishing its tasks or adapting to changing surroundings.

Like other machines, autonomous robots still require regular maintenance

1.1 Indoor navigation

For a robot to associate behaviors with a place (localization) requires it to know where it is and to be able to navigate point-to-point. Such navigation began with wire-guidance in the 1970s and progressed in the early 2000s to beacon-based triangulation. Current commercial robots autonomously navigate based on sensing natural features. The first commercial robots to achieve this were Pyxus' HelpMate hospital robot and the CyberMotion guard robot, both designed by robotics pioneers in the 1980s. These robots originally used manually created CAD floor plans, sonar sensing and wall-following variations to navigate buildings. The next generation, such as MobileRobots' PatrolBot and autonomous wheelchair,[1] both introduced in 2004, have the ability to create their own laser-based maps of a building and to navigate open areas as well as corridors. Their control system changes its path on the fly if something blocks the way. At first, autonomous navigation was based on planar sensors, such as laser range-finders, that can only sense at one level. The most advanced systems now fuse information from various sensors for both localization (position) and navigation. Systems such as Motivity can rely on different sensors in different areas, depending upon which provides the most reliable data at the time, and can re-map a building autonomously.

Rather than climb stairs, which requires highly specialized hardware, most indoor robots navigate handicapped-accessible areas, controlling elevators, and electronic doors.[2] With such electronic access-control interfaces, robots can now freely navigate indoors. Autonomously climbing stairs and opening doors manually are topics of research at the current time.

As these indoor techniques continue to develop, vacuuming robots will gain the ability to clean a specific user-specified room or a whole floor. Security robots will be able to cooperatively surround intruders and cut off exits. These advances also bring concomitant protections: robots' internal maps typically permit "forbidden areas" to be defined to prevent robots from autonomously entering certain regions.

1.2 Outdoor navigation

Outdoor autonomy is most easily achieved in the air, since obstacles are rare. Cruise missiles are rather dangerous highly autonomous robots. Pilotless drone aircraft are increasingly used for reconnaissance. Some of these unmanned aerial vehicles (UAVs) are capable of flying their entire mission without any human interaction at all except possibly for the landing where a person intervenes using radio remote control. Some drones are capable of safe, automatic landings, however. An autonomous ship was announced in 2014—the Autonomous spaceport drone ship—and is scheduled to make its first operational test in December 2014.

Outdoor autonomy is the most difficult for ground vehicles, due to:

- Three-dimensional terrain
- Great disparities in surface density
- Weather exigencies
- Instability of the sensed environment

2.Assistive Robotics

Assistive Robotics is an area of robotics that deals with utilizing robots as tools rather than task based autonomous systems. The use of robotics as an assistive tool requires a special set of metrics rather than the sole use of the conventional task completion time metric. While Assistive Robotics covers multiple areas where robots are utilized as tools, here the focus will be in the area of medical tasks. a In the case of rehabilitation, friendliness, ease of operation, and effectiveness of input device are more suitable to give useful results . The remainder of this section will touch on the development of assistive robotics, discuss clinical applications, and finally the progress in establishing standard benchmarks.

2.1 Technology Development Challenges

This section will focus on the creation of new devices and their usability. One of the difficulties of testing systems in assistive robotics is the low number of trials, which provide good insight, but are limited by human fatigue. Running thousands of trials is not practical or cost effective. The time involved would also prevent the data collected up to this point from being used to analyze the system and improve performance, and thus quality of life. For example, in the case of developing a prosthetic arm, typical metrics were taken into account, such as time to complete a task and accuracy of the task. Beyond these metrics, researchers also monitored blood oxygen levels and carbon dioxide production. This allows an early stage device to be analyzed and compared to its biological counterpart. Since the goal defined by assistive robots is to make tasks easier, a failure to perform at least on par with natural systems means a new look must be taken at the design. The time frame involved is also a critical reason careful thought must be taken when choosing factors to observe. In the case of prosthetic limbs and stroke rehabilitation, testing time ranges are on the order of six months. With such long time frames, including useless factors waste both time and money, while providing little future benefit to patients.

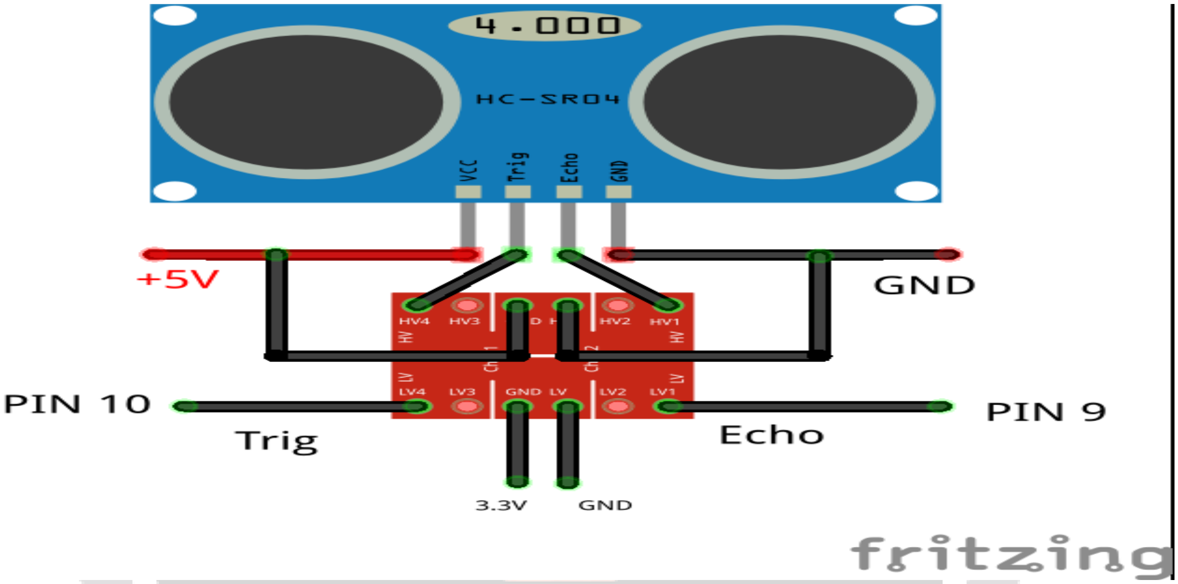
2.2 Clinical Application

This section discuses how assistive technology is applied to a given end-user population. At this stage, assistive robotics are being used on a daily basis, and analysis can be conducted to gauge where future efforts for development are needed. When evaluating the mental efforts used to operate an assistive robotic system, Functional Independence Measure (FIM), Rating Scale for Mental Efforts (RSME), and Standardized Mini-Mental State Examination are commonly used, but other measures do exist [Tsui08]. These scales help provide some level of quantitative data in regards to the performance of assistive robotics systems as perceived by users. This demonstrates the difficulties in trying to generalize robotics to a point of a single evaluation and analysis technique, which will be discussed later.

2.3 Benchmarks and Evaluation

Evaluation performance of assistive robotics can be difficult with the human element present. As proposed by David Feil-Seifer et al.[5] in table 1, a set of benchmark criteria does exist. While it may not be conclusive, it does help future researchers in the field by making them aware of the human element of the system. The derivation of the table stems from a Stanford University experiment, which included questionnai to gather non-quantitative data such as usefulness and ease of use of the ProVAR system.

Mainly arduino uno broad is instruct step by step process to the robot. Ultrasonic sensor sends the signal to arduino uno broad the sends the signal to driven motor .



Other things to keep in mind are where and why a system will be used. Since the systems in this area of robotics are intended to assist human counterparts, high throughput of the robotic system alone may actually be detrimental, as the users ability to process input from the system will not be able to keep up. A clear consensus has emerged in this area, that noting the goal of the system before designing and evaluating it is perhaps the most important step in the evaluation process. Interacting with robots as an assistive tool is only one part of the interaction that takes place between humans and robots. The next section will discuss varying levels of interaction between humans and robotic systems.

3.EVALUATION PITFALLS

As the field of Robotics covers many different domains, there exists a greater chance for evaluation error and bias. Extra care must be used when defining the domain the system will operate in, and what metmportant. Experimentation will help remove some unneeded metrics; however, the development time of a system can be increased beyond an acceptable time if too many variables are under observation.

3.1 Metrics and Data Plotting

While some research papers present solid cases for properly defining metrics, clear presentation of data is sometimes overlooked such as in Figure 5.1 [haddadin09]. In this case lines are labeled by variables, rather than keywords which would increase readability of the chart. This is particularly important as the number of lines presented falls in the 5 to 7 ranges, where the ability to quickly read and comprehend a line chart wanes.

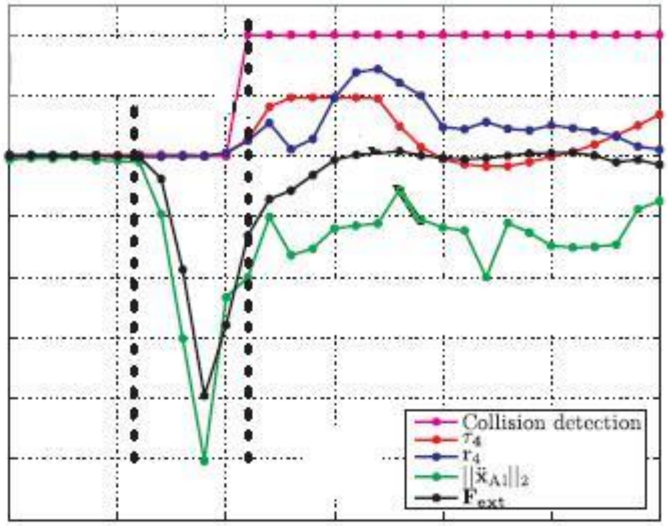


Figure 3.1 A line chart displays the upper limit for the acceptable number of lines

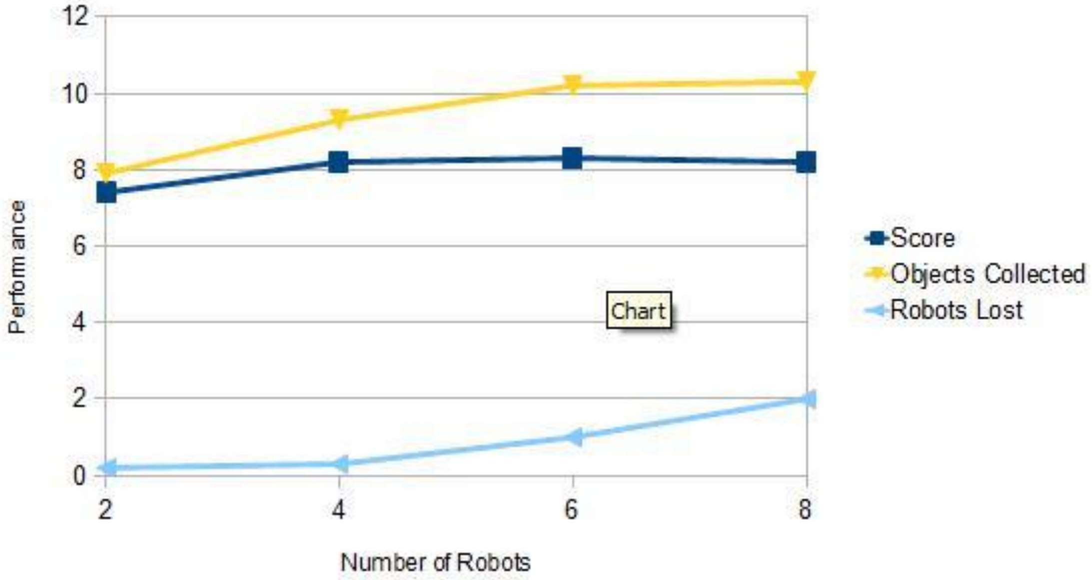


Figure 3.2: Performance as robot team size increases

3.2 Modeling

In the case of modeling robotic systems, one of the most common pitfalls is failure to account for real world anomalies and noise. While the robot is generally thought of as the system understudy, the environment in which it operates is heavily correlated to its performance. Whether performance is measured in time to completion or slanted to human criteria like ease of use, the assumption of a perfect world will introduce errors into the system that will propagate into production systems if not caught.

3.3 Simulation and Benchmarking

As indicated in [helmer09], benchmarking becomes increasing useful when applied to a well defined system in a domain as opposed to the field robotics in general. The use of benchmarks as an ambiguous solution across all aspects of robotics, can actually have an adverse effect on system design due to scope and complexity mismatch of the benchmark and system.

4.CONCLUSION

In conclusion the concepts presented in this paper in regards to robotics can be applied to many other fields as well. The idea that a plan should be well thought out before testing is part of all area of robotics mention, and in general is a best practice. For robotics in particular it is critical that the proper level of autonomy be determined before analysis to properly evaluate system performance. The goal of this paper was to show three levels of metric selection and analysis. These levels included metrics focused on human side of system, metrics with a balance of human and robot factors, and systems focused on the robotic side of systems. The pitfalls mentioned are closely tied to the area of robotics a system is part of, and vary from metric selectof the human element in the design process. It is also important to be mindful of the goals of the systems, and avoid erroneous metrics that will not provided useful analysis.

5. REFERENCES

[1].[Helmer09] Scott Helmer, David Meger et al., "Semantic Robot Vision Challenge: Current State and Future Directions", 2009, "This paper speaks to the need for well defined systems before choosing metrics."

[2].[Yoon] Hobin Yoon/Jungmoo Song et al, "Real-Time Performance Analysis in Linux-Based Robotic Systems", 2009, "Discusses metrics needed to analyze real-time systems."

[3].[Haddadin] Sami Haddadin et al.,"Requirements for Safe Robots: Measurements, Analysis and New Insights", 2009, The International Journal of Robotics Research,"This article shows how the labels of charts can make a difference in readablity."

[4].[Tsui2008] Katherine M. Tsui/Holly A. et al, "Survey of Domain-Specifc Performance Measures in Assistive Robotic Technology", 2008, "This paper discuesses ther various aspects of assistive robotics and how to gauage effectiveness."

[5].[Feil] David Feil-Seifer, Kristine Skinner and Maja J. Mataric, "Benchmarks for evaualting socially assistive robotics", Interaction Studies: Psychological Benchmarks of Human-Robot Inteaction, Vol 8, no 3, pages 423-429, 2007"This paper talks about the social aspect of assistive robotics."

[6].[Freedy] Amos Freedy et al., "Measurement of Trust in Human-Robot Collaboration", 2007,"This paper talks about how trust is key in a system involving human robot interaction.”

[7].[Tsui2009] Katherine Tsui, David Feli-Seifer, et al., "Performance Evaluation Methods for Assistive Robotic Technology", 2009, "This paper discusses methods for evaluating effectivness of assistive robotics."

[8].[Amigoni] Francesco Amigoni, Viola Schia?onati, "Good Experimental Methodologies and Simulation in Autonomous Mobile Robotics", 2010, "This paper talks about how to evaluate the design of autonomus systems."