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Power Tillers and Snails for Demining in Sri Lanka

This paper presents a project the author has been working on since January 2005 in the context of her doctoral research and offers some of the first results. The topic concerns the participatory design and development of a distributed system for humanitarian-demining operations in Sri Lanka. The completed research is expected to encompass the relationship among landmines, humanitarian technologies and development. This article looks at the adaptation of power tillers for demining applications in Sri Lanka using a participatory design methodology called the Snail System.

by Emmanuela Erika Cepolina | University of Genova, Italy

There is a common understanding that research into humanitarian demining technology has not yet provided the positive results initially expected. In the last 10–15 years, hundreds of millions of U.S. dollars have been spent on research, and promising technologies have been developed and tested. However, there has been very limited introduction and integration of new mechanical technologies into common demining practices in the field.

This observation is supported by results from a field study conducted last year in collaboration with the European project, European Union in Humanitarian Demining 2 (EURED2), of which I was a part. Our research focused on collecting information about machines and technologies created for use in the field of humanitarian demining, as well as the efficiency of these tools and end-users’ feedback about them. We found 16 demining machines in use by nine organizations working in the four countries we visited, while the total number of sensor technologies in use by the same organizations was 1,081.

Such a discrepancy in the number of machines and sensors employed by demining organizations is surprising. In fact, while sensors are considered part of equipment assigned to personnel and therefore each deminer has one, the number of machines employed by each organization was generally very low, usually between zero and two items. One exception was a single organization that was using nine different machines.

While gathering various data, we asked nongovernmental organization logistics about the maintenance costs of technologies in terms of the operating cost, salary of operators, downtime due to mechanical failures, time between failures and cost to repair failed machines. Generally, we found a huge difference between the maintenance costs of a machine and that of a sensor. Taking as an example our data gathered in Mozambique, the maintenance cost per month of a machine in use at an organization was US$530 while the cost for maintaining a sensor was US$19. These calculations do not even take into consideration the cost of training, which lasts 25 days for a machine and less than one for a sensor.

Thus, we believe high maintenance costs are one of the key factors behind the low adoption rate of machines by demining organizations. In our calculations, the high maintenance expenses were primarily due to the excessive cost to repair machines, multiplied by the high frequency of machine failures. We concluded demining machines are too expensive to be a practical solution not been conceived by the deminers who use them; nor have most machines been developed specifically for the environment in which they are being used.

Establishing a Participatory Approach to Demining Machine Design

These findings support the argument that there is a need to change the approach of designing new machines to one that is participatory and specially tailored to specific demining environments. Allowing deminers to build the machines they like with richer communication skills to make the participatory contribution more effective. I interviewed groups of deminers to start the research in the right direction, better understand local needs and establish a reciprocal trust between local people and expands coordinating humanitarian operations there.

From Agricultural Machines to Demining Machines

After my solo-trip to Sri Lanka, the research team, which included several staff from the Laboratory of Design and Measurement for Automation and Robotics (PMAReB), spent time formalizing the input received from those working in the field, from defining the environment of the northeastern region of Sri Lanka to organizing the ideas that came up during interviews with local deminers. Most notably, in the field, I gathered information by working on the functional requirements for a system of small, light and cheap demining machines to be used for working close to the deminers. Because of such a system of machines arose from a study I conducted last year in collaboration with EUDEM2 at the University of Genova PMAReB under the supervision of the EUDEM2 team, which co-funded the study. I conducted part of the study in the field, collecting information from end-users. In that study, when deminers were asked about their preferences for new machine technology, they expressed a strong desire for new machines that were small, light and cheap.

Based on these findings, we suggested adapting power tillers to demining applications. Power tillers are widely used and commercially available in Sri Lanka, and they are available secondhand. They are easy to transport as they are small and light, and available...
The Snail System: A Participatory Methodology

The Snail System is a participatory methodology for designing for landmine removal. It is presented to end-users, who make decisions regarding the design of a new technology to be used for landmine removal.

The Snail System involves the following steps:
1. Use of a Snail System to design a new technology for landmine removal.
2. End-users make decisions regarding the design of the new technology.
3. The design process is repeated until a satisfactory result is reached.

The ultimate goal is to increase demining machine use in order to eradicate more effectively landmines safely and efficiently.

Conclusion

By employing power tillers and adapting them to demining applications, we intend to leverage off-the-shelf technology already in use and exploit end-users' knowledge and resources, and will empower local participants. The ultimate goal is to increase demining machine use in order to more effectively eradicate landmines safely and efficiently. This project attempts to both practically apply local resources and participate into machine design, and formalize a successful theory of methodology that applies participation into machine design.

The research project the author has undertaken is presented to inform the community and seek comments. The work proposed has been received with many valuable people, whom she would like to thank for their time.

International Mine Awareness Day Marked Globally

Nane Annan, wife of United Nations Secretary General Kofi Annan, served as keynote speaker for events held by the United Nations Mine Action Service in recognition of International Mine Awareness Day. The day was marked with the screening of the film “The Great War of Little People,” which is about the situation of those affected by landmines.

Mine Action, a mine-action advocacy group sponsored by the United Nations, screened a film featuring an Iraqi amputee and held a discussion panel featuring actor Danny Glover, a Goodwill Ambassador for UNICEF.

The United Nations, which flew 82 white balloons outside its New York complex for the 82 mine-affected countries, estimates 15,000 deaths each year are the result of landmines. About one-tenth of the world’s supply of landmines is emplaced in Angola, according to UNICEF. That country has an amputee population of approximately 70,000 people.

Representatives from the United States were on-hand for the events. Although the United States is not a signatory to the Ottawa Convention, a representative from the U.S. Department of State estimated that the U.S. government has provided more than $500 million for landmine and weapons removal over the past decade.

The Mine Action Information Center at James Madison University observed International Mine Awareness Day with a week of events from April 10 to 13. Landmine Awareness Week began with an information booth on the student commons. Students were given green ribbons in recognition of landmine survivors and could explore the global issue of landmines. The film “Diary of a Pedal Tractor” was screened at the campus movie theater and representatives from the U.S. Department of State came to campus to lead a discussion on U.S. policies regarding landmines and other weapons.

A display at JMU’s Carrier Library was also available to expose students to the landmine issue through photos, maps, and other materials. Ken Rutherford, landmine survivor and Co-Founder of Landmine Survivors Network, closed the week of events with a presentation.

References

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The Snail System was used on the first visit, trying to involve deminers in the design of the new technology from the very beginning. The Snail System will also be used later to involve end-users in the next steps of the design process.

The Snail System allows a progressive involvement of end-users in the design process. Snails are lines connecting subsequent steps of the design process. Of the two antennae for each Snail, one goes into the next, indicating that the design methodology used in the next work package.

The Snail System will also be used later to involve end-users in defining the role of humanitarian demining technologies in development.

By employing power tillers and adapting them to demining applications, we intend to leverage off-the-shelf technology already in use and exploit end-users’ knowledge and resources, and will empower local participants.

The ultimate goal is to increase demining machine use in order to more effectively eradicate landmines safely and efficiently. This project attempts to both practically apply local resources and participate into machine design, and formalize a successful theory of methodology that applies participation into machine design.

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