This is the template for the 1 page proposal (500-600 words) that presents a solution (new usage or suggest improvements on a new technology).

If your proposal is selected for the second stage of the Challenge, you will be asked to expand the description to 10 pages (5000-6000 words) which should be a development of the previously submitted proposal.

IMPORTANT: Students are strongly encouraged to team up in pairs, finding a partner in a different university or country. Teams will get an additional point in the final score.

A fresh view is valued. Please, defend your proposal by including not only technological, but also socio-economic, political, ethical and/or environmental aspects.

SEND TO: challenge@assets-plus.eu

Participant # 1

Name Caren Safa

University Toulouse Capitole University

Country France

Email Karensafa11@gmail.com

Participant #2

Name Mohammad Hajj

University Toulouse Capitole University

Country France

Email M7md7aj107@gmail.com

Subject/title: Shewanella and Termites

In this paper, we address the subject of landmine identification and clearance, specifically in the setting of Ukraine and Russia. About 174,000 square meters of Ukraine's soil have been mined since Russia's full-scale invasion, making it one of the most mined nations in the world. The goal of our project is to employ biotechnology by using genetically modified insects that are conditioned to identify the trip wire of 'Anti-Personnel' landmines along with bacteria that have been genetically engineered to melt down the trip wires, effectively leading to their disconnectivity.

Anti-Personnel landmines are detected and activated by trip wires. However, such wires are coated in thin nylon fishing lines making them invisible. Hence, the best way to detect such landmines is to search for the tripwires themselves. Within this framework, our idea involves around genetically modifying a certain type of insect known as 'Termites', to target particularly the nylon fishing coating and slowly eat through it. Such insects could be conditioned to target Nylon-covered wires recognising them as a food source. This genetic modification can be achieved in several ways including modifying Termites' digestive system to recognise and digest synthetic materials or by altering their chemical receptors enabling them to confuse synthetic material for their nature derived foods. This could be feasible by modifying the genes responsible for chemoreception in Termites through the use of CRISPR technology. After correctly achieving the desired genetic modification, the insects can be spread across the minefields through aerial spraying allowing them to detect the trip wires through the nylon coating, then they would form straight lines on the wires and slowly chew through them.

After the detection process, 'Shewanella' the genetically modified bacteria are set in motion. Shewanella already acquires instinctive abilities to interact with metals. However, differs from many other bacteria in that it has an intriguing electron transport mechanism. To transfer electrons from its internal metabolic activities to external electron acceptors, this bacterium uses an intricate mechanism that interferes with the electron flow. Hence, we could engineer such microorganisms to disrupt the trip wire material by releasing corrosive chemicals. This could be accomplished by creating a sensor responsive circuit that would trigger Shewanella's response when placed on trip wires. Such alteration to the genetic nature could be done through CRISPR cas9, gene cloning or expression systems. After such processes, the bacteria distributed would effectively dissolve the metal components of the wire ultimately leading to their disability and disconnectivity making it safe and easy to dispose landmines.

This proposal requires advanced biotechnology however with the right tools in hands it is feasible. It is also cost effective and could be easily spread across minefields without the use of complicated and heavy machinery that would disrupt the nature of soil and most importantly it is environmentally friendly. Exceptionally, Shewanella has been distinguished for its special qualities that offer great promise for bioremediation, which uses microorganisms to eliminate or neutralise environmental contaminants. Using these methods, which can disable mines over very large areas, because it expands the scope of their spread itself. This bacterium is a vital tool for cleaning up contaminated places because of its capacity to break down organic contaminants and minimise harmful metal ions.

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