

# Automated Logistics Messages - Shot counter

Degree programme : BSc in Micro- and Medical Technology | Specialisation : Sensor technology  
Thesis advisor : Michel Wenzel Moser  
Expert : Dr.Pascal Gaggero  
Industrial partner : RUAG, Bienne

The aim of this research is to have a system, which, thanks to the 'physical phenomena' created by a weapon during firing, counts the number of shots that have been fired. In order to capture these 'phenomena', it was necessary to have different types of sensors. This system would in future lead to fewer errors in ammunition counting.

## Introduction

RUAG is a Swiss company with its headquarters in Bern. It is active in the aerospace, defense and weapons sectors.

One of their new project is about providing the military commander with timely and comprehensive reports on own and enemy troops, weapons and supplies in order to simplify and speed up his decision making process.

Counting of fired bullet is of interest for the soldier that can take this information into account to make further decisions about his mission.

## Goals

The aim of this bachelor thesis was to create a compact system attachable to the assault rifle that, by capturing the rifle's firing, would reliably detect and register the shots fired.

## Methods

The phenomena to be captured are those of sound, acceleration and vibration caused by the mechanics of the weapon. The accelerometer and microphone were mounted on the weapon and then fired to see what kind of signals were being picked up.

## Result

While at the 300 m shooting range without other shooters in close proximity, a system composed of

an off-the-shelf accelerometer and a microphone is capable of detecting rounds fired. With other shooters nearby however, as tested in the short distance shooting range, not only the microphone picks-up the sound of the neighbouring rifle but surprisingly also the accelerometer measures a significantly strong signal.

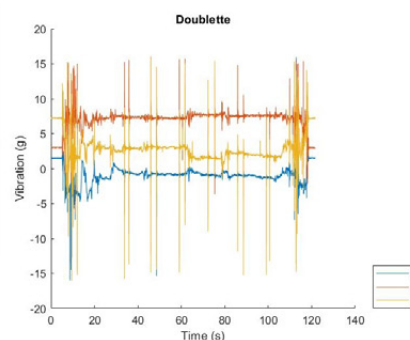
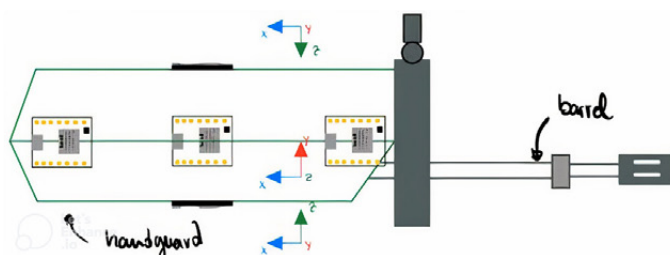
Using another accelerometer with increased dynamic range up to 200 g, shots fired from the own and neighbouring weapons may be discriminated based on the difference in amplitude of the accelerometer's output. Because of the too low sampling rate of commercially available accelerometers however, this method of detection yet suffers from unsatisfactory reliability.

## Outlook

In a future development, the main goal would be to improve the detection's reliability by avoiding to count rounds fired by the neighbouring shooter. Furthermore, as one targets a portable system with improved battery life time, the current consumption shall be reduced.



Anujan Sivalingam  
anujanshiva7@gmail.com



On the right, the picture shows where the different sensors were placed in order to measure the vibrations and sound emitted by the rifle. While on the left is showing, via the peaks, the shots.