# DIGITAL AMMUNITION COUNTER

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Project Sponsor:
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INFORMATION & COMPUTER SCIENCES
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## 2 PRODUCTS

## INTRODUCTIONS

In response to the 25th Infantry Division's quest for enhanced ammunition management, our project endeavors to revolutionize the existing manual counting process. The challenges posed by inconsistency, time consumption, and the potential for errors in the current methodology have prompted the pursuit of a more efficient and accurate solution.

- Project Objectives:
  - Develop an innovative, lightweight, and user-friendly digital solution to overcome manual counting pitfalls.
  - Ensure seamless attachment of the solution to ammo crates, enhancing overall usability.
- Solution Features:
  - Implement measures to mitigate errors and significantly improve efficiency in the ammunition counting process.
  - Integrate real-time tracking capabilities to provide enhanced situational awareness for the 25th Infantry Division.

## METHODOLOGY

In our pursuit of automating ammunition counting, the project's focal point was the implementation of an Arduino-based counting subsystem. Simultaneously, our exploration extended to the domain of machine learning for research purposes.

Concurrently, we collaborated with a student mechanical engineering team in a joint effort to design both the Arduino device and the machine vision prototype, emphasizing a multidisciplinary approach to meet our project objectives.

## CHALLENGES

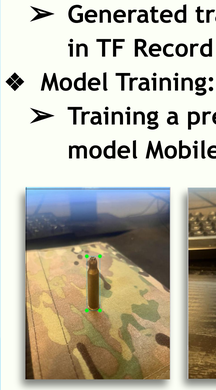
Due to project timeline limitations, our team was unable to fully develop the ammunition classification model beyond initial phases. After completing preliminary training and evaluation of an early model version, progress stalled.

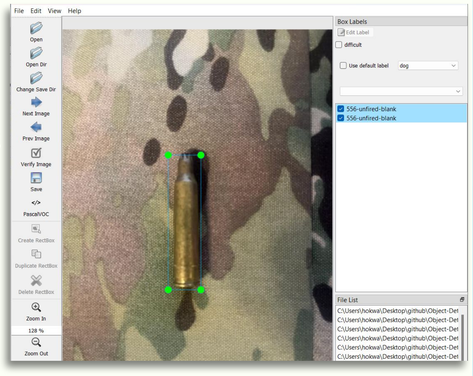
## MACHINE LEARNING RESEARCH

- Exploratory Endeavor:
  - Focused on investigating the potential integration of machine vision for ammunition recognition.
- Framework:
  - Development of a deep neural network classification model using TensorFlow.
- Key Objectives:
  - Recognition of various ammunition types through convolutional layers trained on labeled imagery.
  - Following best practices in machine learning, including gathering training data, manual annotation, iterative training, and statistical evaluation.

## MACHINE LEARNING PROGRESS

- Development Environment Setup:
  - Installed the TensorFlow Object Detection API.
  - Created a virtual environment for machine learning development.
- Data Gathering and Preprocessing:
  - Labeled image data with ammunition types.
  - Updated label maps to accurately identify ammunition classes.
  - Generated training data in TF Record format.
- Model Training:
  - Training a pretrained model MobileNet SSD v2






## TECH STACK


## ARDUINO-BASED COUNTING SYSTEM

- Description: The core of our primary product is an Arduino-based counting subsystem designed for precise and real-time ammunition counting.
- Components:
  - Arduino Microcontroller
  - Infrared Sensor
  - Custom Software Logic
- Functionality:
  - Accurate counting of ammunition pieces
  - Real-time tracking of ammunition quantity
  - Reliable performance in diverse scenarios

## ARDUINO RESULTS

- Made a virtual product of the Arduino device simulating final product.
- Made 1st prototype of the physical product


## LEARNING

The team developed critical knowledge and skills to benefit future efforts. The prototyping process provided experience in requirements analysis, system design, test procedures, and coordination between engineers. Specifically, we strengthened software skills in Arduino C++ programming by applying microcontroller capabilities for automated tracking. Additionally, we gained proficiency in deep learning for object detection to extract insights from data.