sdmay-09: IC Chip: Automated Clay Target Scoring System

Week #1 Report
8/30/2018 – 9/10/2018
Client: Dr. Henry Duwe
Faculty Advisor: Dr. Henry Duwe

Team Members:

Eva Kuntz – Report Manager, Team Communications Leader
Cole Huinker – Hardware Systems Key Concepts Holder
Steven Sleder – Software Systems Key Concepts Holder
Michael Ruden – Hardware Systems Key Concepts Holder
Philip Hand –
Keith Snider – Team Webmaster

Weekly Summary:

In this report, we list our accomplishments from the past week, note any issues we have yet to resolve, and discuss the upcoming week and what tasks we plan to accomplish. In addition, we also take note of each team member's individual contribution and the hours they spent working on tasks related to this project.

Past Week Accomplishments:

Below is a list of what our team has accomplished during this reporting period.

- Learned about the game of skeet shooting and the range layout.→Eva, Mike, Cole, Keith, Philip
- Developed an understanding of why product is needed.
    - Current scoring depends on human eyesight.
    - Older referees may have poor eyesight.
    - Human eye may misclassify targets.
    - Expensive to continually hire referees.
- Met with client to start eliciting product requirements.→full team
    - Product needs to distinguish between a broken (dead) target and a lost target.
    - Product must display the classification of the target to human user (i.e. display "dead" or "lost") via a LED light (green versus red) or with words ("dead" versus "lost").
    - Algorithm that classifies targets must classify the current shot within 2 seconds.
    - Discussed possibility of using machine learning algorithm to recognize and classify clay targets.-->Steven and Mike.
    - Reviewed layout and rules of skeet shooting.
    - Discussed tradeoffs of using a high resolution vs. a high frame rate camera for product.→Mike and Cole
        - Decided on high resolution since we will use image recognition.
    - Product must connect wirelessly to a smartphone or tablet for target classification and review or override by a human user.

- Created a data collection and data storage plan.→ Eva and Steven
    - NOTE: Please see attached sheet at the end of this document for the data collection and storage plan.
- Researched machine learning algorithms.→Steven
    - Reviewed algorithms that can track and recognize 2 or more targets (as in the case of pedestrian tracking).
- Reviewed and researched video recording equipment for a project prototype.→Mike
    - Video Camera - Canon VIXIA HF R80 https://www.cnet.com/products/canon-vixia-hf-r80/specs/
    - Video Camera Tripod

Pending Issues:

- Protection of camera from clay pigeon fragments.
- Understand difference between broken (dead) and lost clay targets.
- Develop program to split (data collection) video recording into fragments representing a shot in real time.

Individual Contributions:

Team Member	Contribution	Weekly Hours	Total Hours
Eva Kuntz	**Elicited project requirements; Researched skeet shooting/range layout; Helped create data collection and storage plan.**	**8**	**8**
Cole Huinker	**Researched video equipment; Elicited project requirements; Planned for data collection logistics.**	**6**	**6**
Steven Sleder	**Researched machine learning algorithms and computer vision information; Helped create data collection and storage plan.**	**6**	**6**
Michael Ruden	**Researched video equipment and tradeoff between high res/high frame rate.**	**6**	**6**
Philip Hand	**Researched game rules and machine learning algorithms/techniques; Researched wifi/Bluetooth connection capabilities.**	**7**	**7**
Keith Snider	**Lightning Talk Prep, Requirements Discussion**	**2**	**2**

Plans for the Upcoming Week:

Below we list our plans for the upcoming week.

- Development Model→team
    - Select a language and a framework for our project.
- Requirement Elicitation→Eva and Keith

    - Continue to elicit and define specific project requirements from client.
    - Understand what the client wants and needs regarding the smartphone application
- Continue researching machine learning algorithms→Steven
- Research wireless technology for smartphone/device wireless connection→Mike, Eva, and Keith
- Draft a semester plan including major and minor project milestones and goals→team
- Determine hardware necessary for a ground station
    - Perform cost analysis
    - Determine if equipment is portable
    - Determine if equipment can connect wirelessly to a smartphone
- Understand ruggedness requirements→Mike, Cole, and Philip

Technical Specifications for Data Collection and Storage

1. Checkout and borrow digital video camera from ISU Parks Library.
    a. Checkout two or more cameras
    b. 1080p at 60 Hz
2. Collect range measurements.
3. Position camera at stations 1, 4, and 7 on range to record Dr. Duwe and other volunteer shooting clay pigeons as they move from station to station.
    a. Cameras will start recording before the first shot of the session.
    b. Cameras will continue recording throughout the entire shooting session.
    c. Cameras will stop recording after the last shot of the session.
    d. Session will be approximately 1-2 hours in length; Dr. Duwe, as client, can confirm this.
4. Human referee will stand by and score the clay targets as either “broken” or “lost” (not broken). Human referees’ score cards will be recorded for later analysis.
5. Goal is to collect recording of a minimum of 200 clay targets; recording shots from multiple angles.
6. Camera video data will be viewed and edited in order to split video recording into shorter videos of each shot attempt.
    a. Write program to parse video based on spikes in audio representing a shot in real time
7. Data will be sorted and labeled by classification (*dead/lost*) as well as by station and camera position by our team members.
8. Data will be stored in a folder on CyBox so all team members and client will have access to the classified data.
    a. CyBox is a free service for students.
    b. CyBox gives us 50GB of storage.
    c. If the volume of data we collect exceeds 50GB, we can purchase more storage from ISU Large Scale Storage at $40 per terabyte.
9. Data will then be used to train a machine learning model to be used in conjunction with a computer vision algorithm to track movement and potential state change of the target.
    a. Convolutional Neural Network for state change.
    b. You Only Look Once algorithm for tracking.