

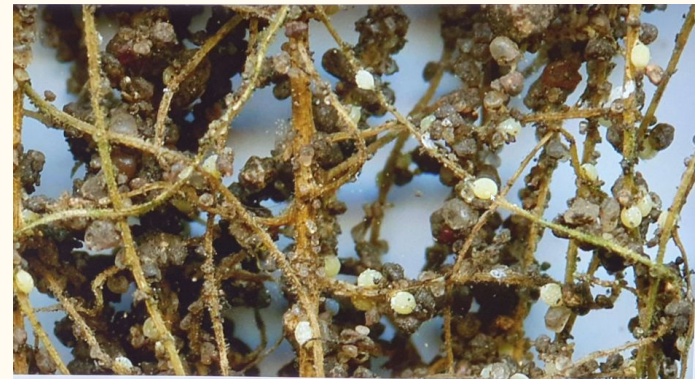
Requirements, Realistic Constraints, Eng Standards

Senior Design 491: Soybean Parasitic Cyst Detector

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Problem Statement

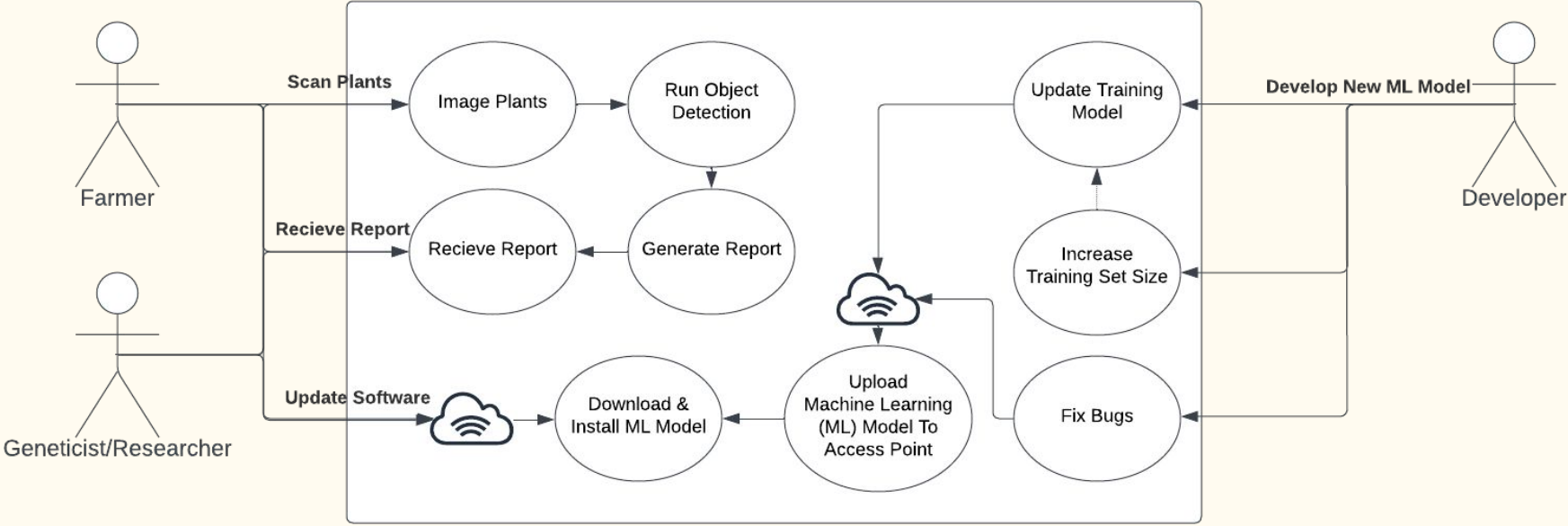
- Develop a deep learning algorithm designed for small object detection to determine how many parasitic cysts are on the roots of soybean plants.
- Will also create a device to integrate image capturing with the machine learning algorithm.
- Increases productivity in farms.
- Reduces the amount of unnecessary pesticides.
- Helps farmers accurately fertilize their crops.



Intended User

- Middle Aged Farmers
- Remotely located soybean Farm
- Owns tractor and plowing and fertilizing equipment for soybeans.
- Family Man
- Focuses on cutting costs and optimizing time spent working on crops
- Inefficient care for soybean crops has caused financial hardship because of resulting over use of fertilizer (increased costs) or under use of fertilizer (loss of crops).
- Sending plants for accurate analysis of crop parasitic cyst density to labs loses growing season time and money waiting for the results.

Use Case Diagram



Requirements and Constraints

- **Software (Algorithm)**

- Functional without internet access
 - Independent of software upgrades (no server)
- Better than 50% accuracy for detecting cysts in images **(Constraint)**
- Less than 1 second of processing time per image **(Constraint)**
- Less than 1GB space taken by the application **(Constraint)**

- **Hardware**

- High-enough image resolution to use for object detection
- Portable (Wireless, can be used on a field)
- Does not damage plants

Requirements and Constraints Continued

- **Resources**
 - Processors/Processing time to train the algorithm
 - Materials to build a prototype device
 - Cameras
 - Motors (depending on prototype design)
 - Misc building materials (aluminum, plexiglass, screws, wires, etc)
- **Qualitative Aesthetics Requirements**
 - Keep the device as small as possible
 - Easy to transport
- **Economic/Market Requirements**
 - Create a final device that is affordable for farmers
 - Upper limit around \$500 (**Constraint**)
- **Environmental Requirements**
 - Must not damage plants in any way
 - Provide an accurate number of cysts to avoid an overuse of pesticide consumption
- **UI/UX Requirements**
 - Farmer should not interact with product during image capture process
 - No formal training required to use the device

Engineering Standards

IEEE 268-1992: American National Standard for Metric Practice

- **Justification:** Our return metric is the parasitic cyst density in a unit area. Simply counting the number of cysts will not be sufficient because various soybean plants of different sizes will have more total cysts than others. Thus, we will need to abide by SI standard metrics and return a unit density of parasitic cysts in an area.

32675-2021 - ISO/IEC/IEEE International Standard--Information technology--DevOps--Building reliable and secure systems including application build, package and deployment

- **Justification:** This standard applies to our packaging and deployment of the software package that will include our parasitic cyst detection algorithm. We will need to provide a routine and regularly available service for updates for our algorithm to be downloaded on the devices with the application. While our app does not need to have wifi/internet connection to work, we can build a github page or webpage for rolling out these updates. Consequently, the updates will be at the owner's convenience and readily available.

Engineering Standards Continued

IEEE/ISO/IEC 14764-2021 - ISO/IEC/IEEE International Standard - Software engineering - Software life cycle processes - Maintenance

- **Justification:** We will be developing a software product from start to finish, and these standards provide guidance for procedures and guidelines to follow during that process.

IEEE/ISO/IEC P24748-6: ISO/IEC/IEEE Draft Standard - Systems and Software Engineering -- Life Cycle Management

- **Justification:** Although our team is will not be maintaining this project prior to the end of EE 492, it is important that we spend time documenting our ideas of the life cycle of the project. The entire lifecycle of the project starts at development. Without our project team documenting our intention for the project, it is possible that further development would not occur.

Standard for Measures of the Software Aspects of Dependability

- **Justification:** Even though our product will support updates, it needs to be able to run on its own, without internet access or software updates if the consumer doesn't have access to them. As such, it needs to be a high-quality, reliable product. If a bug bricks our device, the consumer wouldn't be able to fix that very easily, so we need to ensure that doesn't happen.

Questions?