# SCBGP PROJECT PROFILE TEMPLATE

## AWARD YEARS 2022 FORWARD

The State Plan should include a series of project profiles that detail the necessary information to fulfill the goals and objectives of each project. The acceptable font size for the narrative is 11 or 12 pitch with all margins at 1 inch. The following information must be included in each project profile.

## PROJECT TITLE

*Provide a descriptive project title in 15 words or less in the space below.*

Applying video analytics to document food safety processes and practices

## DURATION OF PROJECT

**Start Date**: September 30, 2023          **End Date**: September 29, 2025

## PROJECT PARTNER AND SUMMARY

*Include a project summary of <u>250 words or less</u> suitable for dissemination to the public. A Project Summary provides a very brief (one sentence, if possible) description of your project. A Project Summary includes:*

1. *The name of the applicant organization that if awarded a grant will establish an agreement or contractual relationship with the State Department of Agriculture to lead and execute the project,*
2. *The project's purpose, deliverables, and expected outcomes and*
3. *A description of the general tasks/activities to be completed during the project period to fulfill this goal.*

> **FOR EXAMPLE:**
> The ABC University will mitigate the spread of citrus greening (Huanglongbing) by developing scientifically-based practical measures to implement in a quarantine area and disseminating results to stakeholders through grower meetings and field days.

Purdue University will design, build, implement, and evaluate an automated system that documents food safety processes and practices. The system will rely on automated video analytics to monitor human activities in a post-harvest processing facility, and will consist of commercially available cameras, a low-cost laptop computer, and a video analytics algorithm. This algorithm will be designed to verify that the necessary steps and activities within selected Good Agricultural Practices (GAPs) for specialty crops occurred during food handling. The video analytics algorithm will be designed and evaluated to ensure that it is effective across the range of environments encountered in a typical Indiana post-harvest processing facility.

Purdue University will disseminate the basic concept to the stakeholders through grower meetings, Good Agricultural Practices (GAPs) grower trainings offered by Purdue Extension, and field days that are held yearly at the Purdue Agriculture Centers (PACs) located throughout Indiana. In addition, Purdue University will disseminate the methodology to the appropriate technical communities.

## PROVIDE A PROJECT TIMELINE BY QUARTER AND YEAR BELOW.

Even though the beginning timeline of this grant does not align well with the harvesting season in Indiana, we will be able to start immediately on this project.

In Y1Q1, we will start designing our system with some already recorded videos of washing lettuce and other leafy greens at the Purdue Student Farm. These videos were recorded during 2019 and 2021 using two different sets of cameras, for over 60 hours of activities. The previously used camera systems are not identical to our proposed multi-camera system, but they will enable us to begin exploring the ability of different camera locations to observe the key actions of food-safety plans for post-harvest processing of lettuce.

In addition, we will procure new cameras and begin designing and installing the proposed camera system for this project. Multiple cameras will be installed to enable us to explore which locations provide the most consistent and informative view for the proposed task.

Also in Y1Q1 and Y1Q2, we will perform a literature review of action detection and recognition methods, focusing specifically on human activities and on human-to-object interactions. We will build out the video processing pipeline and infrastructure in Y1 Q1 and Q2. We will also design and prototype our user interface for communicating with post-harvest workers about what are the required steps and whether or not they have been observed performing them.

In Y1 and Y2, Q3 and Q4, we will systematically and routinely record post-harvest activities of leafy greens and other specialty crops at the Purdue Student Farm, as these crops are harvested. These videos will be backed up and the manual processing associated with designing a video analytics system will begin.

In Y2 Q1 and Q2, we will focus on developing the video analytics algorithm. In addition, we will refine our user interface based on informal feedback we receive from users during post-harvest in Y1Q3 and Y1Q4.

## DESCRIBE HOW YOUR ORGANIZATION WILL INTERACT WITH ANY PARTNERS ON YOUR PROJECT.

A key component in the development of video analytics systems is the collection of videos that observe the desired actions. We will work with managers and co-directors at the Purdue Student Farm to collect video observations of students performing Good Agricultural Practices, according to Purdue IRB #1804020457 which currently expires in August 2025.

The Purdue Student Farm is a small, sustainable farm located near the Kampen Golf Course and Daniel Turf Center off Cherry Lane in West Lafayette, IN. They grow fruits, vegetables and herbs using the principles that naturally govern balanced ecosystems. The Purdue Student Farm also emphasize the education of Purdue undergraduate students through sustainable farming methods. Their educational work is all about food:

• How food can be grown effectively on a small scale

• How food can and should be marketed for profit

• How food utilization can affect the farmer and community

• How food intersects with the economy and the environment

## PROJECT PURPOSE

### PROVIDE THE SPECIFIC ISSUE, PROBLEM OR NEED THAT THE PROJECT WILL ADDRESS

Food-borne illnesses are on the rise, with over 9 million Americans being sickened every year. However, illness frequency can be significantly diminished through the use of Good Agricultural Practices (GAPs). This project will address the goal of simplifying the documentation and record-keeping of having implemented GAPs by specialty-crop growers throughout the state of Indiana. The system we will develop can be used by local growers (a) within their daily workflow to ensure correct procedures are followed, and (b) to establish documentation that can assist growers successfully pass a third-party audit that verifies Good Agricultural Practices are followed.

### PROVIDE A LISTING OF THE OBJECTIVES THAT THIS PROJECT HOPES TO ACHIEVE

*Add more objectives by copying and pasting the existing listing or delete objectives that aren't necessary.*

| Objective 1 | Objective 1: Design, build, and install multi-camera system to observe and record food-safety activities in a post-harvest facility. This will be ongoing throughout the project with iterative improvements. |
|---|---|
| Objective 2 | Objective 2: Record and store videos of post-harvest activities of processing lettuces and other leafy greens, in accordance with Purdue IRB #1804020457, inside an Indiana post-harvest facility. This will occur yearly during the April - September time period as crops are harvested. |
| Objective 3 | Objective 3: Design, build, and evaluate a video analytics system that automatically determines whether the visible activities in a Food Safety Plan were implemented during post-harvest activities. Initial focus will be to observe "washing fresh produce using a 3-bay wash sink", for which some steps include scrubbing, rinsing, filling, and draining a sink, and adding or removing produce from sink.<br><br>This objective also includes periodic literature review of the current video analytics activity recognition algorithms, as well as an analysis of GAP activities. |
| Objective 4 | Objective 4: Distribute information about and advertise the video analytics system both to the relevant technical community (through journal articles and conference presentation) and to specialty-crop growers throughout the state of Indiana at GAPs training workshops. |
| Objective 5 | Objective 5: Design, prototype, and evaluate an automated documentation system with easy-to-use user interface to create records verifying correct execution of a Food Safety Plan. Evaluation will include feedback from growers about their satisfaction in using the prototype system. |

### PROJECT BENEFICIARIES

**Estimate the number of project beneficiaries**: 30

**Does this project directly benefit socially disadvantaged farmers and/or underserved communities as defined in the RFA?**      Yes ☐    No ☑

If you selected yes, please describe how the project directly benefits socially disadvantaged farmers and/or underserved communities.

We are not targeting any sub-population and are open to influencing any specialty crop growing operation whose participants are present during our outreach efforts.

**Does this project directly benefit beginning farmers as defined in the RFA?**      Yes ☑    No ☐

If you selected yes, please describe how the project directly benefits beginning farmers.

**Does this project directly benefit veteran farmers as defined in the RFA?**      Yes ☐    No ☑

If you selected yes, please describe how the project directly benefits veteran farmers.

## STATEMENT OF ENHANCING SPECIALTY CROPS

By checking the box to the right, I confirm that this project enhances the competitiveness of specialty crops in accordance with and defined by the Farm Bill. Further information regarding the definition of a specialty crop can be found at www.ams.usda.gov/services/grants/scbgp.    ☑

List of Specialty Crops: cantaloupe, watermelon, apples, and leafy greens

## CONTINUATION PROJECT INFORMATION

**Does this project continue the efforts of a previously funded SCBGP project?**      Yes ☐    No ☑

*If you have selected "yes", please address the following:*

### DESCRIBE HOW THIS PROJECT WILL DIFFER FROM AND BUILD ON THE PREVIOUS EFFORTS

While the proposed project is not a true continuation of our previous project (IGG-15), it does expand and build on it. Our previous project (IGG-15) considers video analytics to monitor hand hygiene activities. Since hand-washing is visually very different than the food safety procedures considered in this project, a new system must be designed. In particular, a person is typically not moving around when washing their hands, while Good Agricultural Practices (GAPs) for a post-harvest facility will have to accommodate people moving within a large room. The proposed project builds on our previous project by leveraging our increased knowledge about building effective camera systems for a post-harvest facility. In addition, in our funded project, we have developed an initial infrastructure for obtaining, storing, and processing the large amounts of video data that the proposed project will require.

### PROVIDE A SUMMARY (3 TO 5 SENTENCES) OF THE OUTCOMES OF THE PREVIOUS EFFORTS

While our previous project (IGG-15) is not yet complete, we have achieved many of our objectives, and work continues to complete them. We have a prototype system that observes people washing their hands at a portable sink (typical for a post-harvest facility), and provides real-time feedback about whether they are performing the correct

steps. By the completion of the project, we will have enhanced the competitiveness of specialty crops by creating a novel, viable technology to improve hand hygiene and hence improve food safety. We will have presented information about our technology to at least 6 difference audiences, which will have increased the food safety skills of each audience member. We will have published a journal paper (viewed over 1500 times) and a 6-page conference paper on the technology we developed through IGG-15.

## PROVIDE LESSONS LEARNED ON POTENTIAL PROJECT IMPROVEMENTS

**What was previously learned from implementing this project, including potential improvements?**

In our previous project, we learned several approaches for building an effective camera system for a post-harvest facility. We also learned strategies to adapt computer video algorithms into effective systems for real-world food-safety applications. We learned more about how environmental lighting and camera positioning affects how well a camera can observe hand-hygiene activities both indoors and outdoors of a post-harvest facility. We began to learn about perception of workers and growers to having an automated system monitor and provide feedback on the effectiveness of their activities.

**How are the lessons learned and improvements being incorporated into the project to make the ongoing project more effective and successful at meeting goals and outcomes?**

The PI and co-PI for this project are the same as the previous project, and the engineering graduate student will remain the same for the first year of the proposed project. As a result, the knowledge obtained will transfer directly. Specifically, we will improve the existing camera system with new camera angles, expand our collected database of video recordings of food-safety activities, and build on our existing algorithm design to continue to improve the robustness of a video analytics system to the varied environments and people present in a post-harvest facility.

## DESCRIBE THE LIKELIHOOD OF THE PROJECT BECOMING SELF-SUSTAINING AND NOT INDEFINITELY DEPENDENT ON GRANT FUNDS

Due to the nature of the project (designing, building, developing, evaluating), it is not envisioned that the project will require indefinite funding. However, it is entirely likely that our findings during this project provide hope and promise that continued development of a similar automated system to document food safety GAPs will encourage new projects to refine and expand the proposed system beyond the current project. If so, additional funds would be sought from ISDA, from USDA National Institute of Food and Agriculture (NIFA), from National Science Foundation, as well as interested companies.

## OTHER SUPPORT FROM FEDERAL OR STATE GRANT PROGRAMS

The SCBGP will not fund duplicative projects. Did you submit this project to a Federal or State grant program other than the SCBGP for funding and/or is a Federal or State grant program other than the SCBGP funding the project currently?

**Yes** ☐ **No** ☐

## IF YOUR PROJECT IS RECEIVING OR WILL POTENTIALLY RECEIVE FUNDS FROM ANOTHER FEDERAL OR STATE GRANT PROGRAM

**Identify the Federal or State grant program(s).**

**Describe how the SCBGP project differs from or supplements the other grant program(s) efforts.**



## EXTERNAL PROJECT SUPPORT

*Describe the specialty crop stakeholders who support this project and why (other than the applicant and organizations involved in the project).*

Purdue Student Farms
As mentioned in their attached supporting letter, this organization is concerned about food-safety, and believes that this project will address growers' needs concerning documentation and record-keeping of the Good Agricultural Practices (GAPs) they implement, and will enable growers to easily pass third-party audits.

## EXPECTED MEASURABLE OUTCOMES

### SELECT THE APPROPRIATE OUTCOME(S) AND INDICATOR(S)/SUB-INDICATOR(S)

*You must choose at least one of the eight outcomes listed in the SCBGP Performance Measures, which were approved by the Office of Management and Budget (OMB) to evaluate the performance of the SCBGP on a national level.*

### OUTCOME MEASURE(S)

*Select the outcome measure(s) that are applicable for this project from the listing below.*

☐ **Outcome 1:** Increasing Consumption and Consumer Purchasing of Specialty Crops
☐ **Outcome 2**: Increasing Access to Specialty Crops and Expanding Specialty Crop Production and Distribution
☑ **Outcome 3**: Increase Food Safety Knowledge and Processes
☐ **Outcome 4**: Improve Pest and Disease Control Processes
☐ **Outcome 5**: Develop New Seed Varieties and Specialty Crops
☐ **Outcome 6**: Expand Specialty Crop Research and Development
☐ **Outcome 7**: Improve Environmental Sustainability of Specialty Crops

### OUTCOME INDICATOR(S)

*Provide at least one indicator listed in the SCBGP Performance Measures and the related quantifiable result. If you have multiple outcomes and/or indicators, repeat this for each outcome/indicator.*

> **FOR EXAMPLE:**
> Outcome 1, Indicator 1.1a
> Total number of consumers who gained knowledge about specialty crops, Adults <u>132.</u>

| Outcome 3, Indicator 1 |
|---|
| Number of stakeholders that gained knowledge about prevention, detection, control, and/or intervention food safety practices, including relevant regulations (to improve their ability to comply with the Food Safety Modernization Act (FSMA) and/or meet the standards for aligned third party food safety audits such as Harmonized GAP/GHP) [30]. |

| Outcome 3, Indicator 4 |
|---|
| Number of prevention, detection, control, or intervention practices developed or enhanced to mitigate food safety risks [1]. |

## MISCELLANEOUS OUTCOME MEASURE

*In the unlikely event that the outcomes and indicators above the selected outcomes are not relevant to your project, you must develop a project-specific outcome(s) and indicator(s) which will be subject to approval by AMS.*

## DATA COLLECTION TO REPORT ON OUTCOMES AND INDICATORS

*Explain how you will collect the required data to report on the outcome and indicator in the space below.*

Our automated GAP documentation system is [1] new practice to mitigate food safety risks. We expect at least 30 growers to be present during our outreaches regarding our automated GAP documentation system, at least [10] will gain knowledge. [5] of these will establish a food safety plan and another [5] will revise or update their food safety plan.
To verify that our new GAP documentation system is effective, we will conduct interviews with the manager(s) at the Purdue Student Farm to determine their satisfaction (and their workers' satisfaction) with our automated system.

## BUDGET NARRATIVE

*All expenses described in this Budget Narrative must be associated with expenses that will be covered by the SCBGP. If any matching funds will be used and a description of their use is required by the State department of agriculture, the expenses to be covered with matching funds must be described separately. Applicants should review the Request for Applications section 4.7 Funding Restrictions prior to developing their budget narrative.*

## BUDGET SUMMARY

| Expense Category | Funds Requested |
|---|---:|
| **Personnel** | $105,653.00 |
| **Fringe Benefits** | $15,222.00 |
| **Travel** | $4,000.00 |
| **Equipment** | $0.00 |
| **Supplies** | $3,000.00 |
| **Contractual** | $0.00 |
| **Other** | $22,121.00 |
| **Direct Costs Sub-Total** | $149,996.00 |
| **Total Budget** | $149,996.00 |

## PERSONNEL

*List the organization's employees whose time and effort can be specifically identified and easily and accurately traced to project activities that enhance the competitiveness of specialty crops. See the Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Salaries and Wages, and Presenting Direct and Indirect Costs Consistently under section 4.7.1 for further guidance.*

| # | Name/Title | Level of Effort (# of hours OR % FTE) | Funds Requested |
|---|---|---|---|
| 1 | **Amanda Deering, Co-Principal Investigator** | 0.05 % | $13,527.00 |

| # | Name/Title | Level of Effort (# of hours OR % FTE) | Funds Requested |
|---|---|---|---|
| 2 | Amy Reibman, Principal Investigator | 0.43 % | $24,009.00 |
| 3 | To be determined, Graduate Student | 0.50 % | $62,117.00 |
| 4 | To be determined, Undergraduate Student | 600 | $6,000.00 |

**Personnel Subtotal: $105,653.00**

## PERSONNEL JUSTIFICATION

*For each individual listed in the above table, describe the activities to be completed by name/title including approximately when activities will occur. Add more personnel by copying and pasting the existing listing or deleting personnel that aren't necessary.*

| Personnel 1: | Supervise the undergraduate student in gathering video recordings of GAP activities in a variety of environments. She will participate in regular project meetings, help prepare reports to the funding organization, & write conference abstracts & journals. |
|---|---|
| Personnel 2: | Responsible for the overall management of the project. This includes monitoring and documenting the progress, determining deadlines, submitting required reports to the funding organization, and coordinating scientific work and publication. |
| Personnel 3: | Design, build, & evaluate the video processing system for documenting food safety procedures.<br>Participate in regular project meetings, help prepare required reports to the funding organization, & contribute to scientific work & publications. |
| Personnel 4: | Assist in gathering and storing video data associated with building and designing the automated GAP documentation system. |

## FRINGE BENEFITS

*Provide the fringe benefit rates for each of the project's salaried employees described in the Personnel section that will be paid with SCBGP funds.*

| # | Name/Title | Fringe Benefit Rate | Funds Requested |
|---|---|---|---|
| 1 | Amanda Deering, Co-Principal Investigator | 0.27 % | $3,648.00 |
| 2 | Amy Reibman, Principal Investigator | 0.27 % | $6,475.00 |
| 3 | To be determined, Graduate Student | 0.07 % | $4,603.00 |
| 4 | To be determined, Undergraduate Student | 0.08 % | $496.00 |

**Fringe Subtotal: $15,222.00**

## TRAVEL

*Explain the purpose for each Trip Request. Please note that travel costs are limited to those allowed by formal organizational policy; in the case of air travel, project participants must use the lowest reasonable commercial airfares. For recipient organizations that have no formal travel policy and for-profit recipients, allowable travel costs may not exceed those established by the Federal Travel Regulation, issued by GSA, including the maximum per diem and subsistence rates prescribed in those regulations. This information is available at http://www.gsa.gov. See the Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Travel, and Foreign Travel for further guidance.*

| # | Trip Destination | Type of Expense (airfare, car rental, hotel, meals, mileage, etc.) | Unit of Measure (days, nights, miles) | # of Units | Cost per Unit | # of Travelers Claiming the Expense | Funds Requested |
|---|---|---|---|---|---|---|---|
| 1 | Year 2 technical conference | hotel | nights | 3.0 | $150.00 | 2 | $900.00 |
| 2 | Year 1 technical conference (Example CVPR 2024 in Seattle Washington) | airfare | dollars | 2.0 | $490.00 | 2 | $980.00 |
| 3 | Purdue Field Day | mileage | miles | 100.0 | $0.49 | 1 | $49.00 |
| 4 | Year 1 technical conference | hotel | nights | 3.0 | $150.00 | 2 | $900.00 |
| 5 | Purdue Field Day | mileage | miles | 100.0 | $0.49 | 1 | $49.00 |
| 6 | Year 1 technical conference | mileage | miles | 145.0 | $0.49 | 2 | $71.00 |
| 7 | Year 2 technical conference (Example Electronica Imagine 2025 San Francisco) | airfare | dollars | 2.0 | $490.00 | 2 | $980.00 |
| 8 | Year 2 technical conference | mileage | miles | 145.0 | $0.49 | 2 | $71.00 |

**Travel Subtotal: $4,000.00**

## TRAVEL JUSTIFICATION

*For each trip listed in the above table describe the purpose of this trip and how it will achieve the objectives and outcomes of the project. Be sure to include approximately when the trip will occur. Add more trips by copying and pasting the existing listing or delete trips that aren't necessary.*

| | |
|---|---|
| Trip 1 (Approximate Date of Travel ): | Potential conferences include the Computer Vision and Pattern Recognition (CVPR) and Electronic Imaging (EI). CVPR 2024 will be held in Seattle, Washington. The locations of the 2025 and 2026 CVPR conferences have yet to be announced. |
| Trip 2 (Approximate Date of Travel ): | Potential conferences include the Computer Vision and Pattern Recognition (CVPR) and Electronic Imaging (EI). CVPR 2024 will be held in Seattle, Washington. The locations of the 2025 and 2026 CVPR conferences have yet to be announced. |
| Trip 3 (Approximate Date of Travel ): | Year 1 Purdue Field Day |
| Trip 4 (Approximate Date of Travel ): | Potential conferences include the Computer Vision and Pattern Recognition (CVPR) and Electronic Imaging (EI). CVPR 2024 will be held in Seattle, Washington. The locations of the 2025 and 2026 CVPR conferences have yet to be announced. |
| Trip 5 (Approximate Date of Travel ): | Year 2 Purdue Field Day |
| Trip 6 (Approximate Date of Travel ): | Potential conferences include the Computer Vision and Pattern Recognition (CVPR) and Electronic Imaging (EI). |

| | |
|---|---|
| | CVPR 2024 will be held in Seattle, Washington. The locations of the 2025 and 2026 CVPR conferences have yet to be announced. |
| Trip 7 (Approximate Date of Travel ): | Potential conferences include the Computer Vision and Pattern Recognition (CVPR) and Electronic Imaging (EI). CVPR 2024 will be held in Seattle, Washington. The locations of the 2025 and 2026 CVPR conferences have yet to be announced. |
| Trip 8 (Approximate Date of Travel ): | Potential conferences include the Computer Vision and Pattern Recognition (CVPR) and Electronic Imaging (EI). CVPR 2024 will be held in Seattle, Washington. The locations of the 2025 and 2026 CVPR conferences have yet to be announced. |

## CONFORMING WITH YOUR TRAVEL POLICY

By checking the box to the right, I confirm that my organization's established travel policies will be adhered to when completing the above-mentioned trips in accordance with 2 CFR 200.474 or 48 CFR subpart 31.2 as applicable.    ☑

## EQUIPMENT

*Describe any special purpose equipment to be purchased or rented under the grant. ''Special purpose equipment'' is tangible, nonexpendable, personal property having a useful life of more than one year and an acquisition cost that equals or exceeds $5,000 per unit and is used only for research, medical, scientific, or other technical activities. See the Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Equipment - Special Purpose for further guidance*

*Rental of "general purpose equipment'' must also be described in this section. Purchase of general purpose equipment is not allowable under this grant. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Equipment - General Purpose for definition, and Rental or Lease Costs of Buildings, Vehicles, Land and Equipment.*

| # | Item Description | Rental or Purchase | Acquire When? | Funds Requested |
|---|---|---|---|---|
| 1 | | | | |

**Equipment Subtotal: $0.00**

## EQUIPMENT JUSTIFICATION

*For each Equipment item listed in the above table describe how this equipment will be used to achieve the objectives and outcomes of the project. Add more equipment by copying and pasting the existing listing or delete equipment that isn't necessary.*

| Equipment 1: | |
|---|---|

## SUPPLIES

*List the materials, supplies, and fabricated parts costing less than $5,000 per unit and describe how they will support the purpose and goal of the proposal and enhance the competitiveness of specialty crops. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Supplies and Materials, Including Costs of Computing Devices for further information.*

| Item Description | Per-Unit Cost | # of Units/Pieces Purchased | Acquire When? | Funds Requested |
|---|---|---|---|---|
| Additional components for video capture equipment system | $500.00 | 2.0 | October 1, 2024 | $1,000.00 |
| Video capture equipment | $2,000.00 | 1.0 | October 2, 2023 | $2,000.00 |

**Supplies Subtotal: $3,000.00**

## SUPPLIES JUSTIFICATION

*Describe the purpose of each supply listed in the table above purchased and how it is necessary for the completion of the project's objective(s) and outcome(s).*

| |
|---|
| Additional components for video capture equipment system: Years 2 and 3, additional components (up to $500 per year) will be purchased to replace & supplement the system. Several additional cameras will be purchased each year to replace any damaged ones & to add additional views to improve system performance. |
| Video capture equipment: Funds will be used to purchase video capture equipment. A complete capture system includes cameras, storage disks, power over ethernet cables, and a small portable laptop. During Year 1, a complete system will be purchased with an expected cost of $2000. |

## CONTRACTUAL/CONSULTANT

*Contractual/consultant costs are the expenses associated with purchasing goods and/or procuring services performed by an individual or organization other than the applicant in the form of a procurement relationship. If there is more than one contractor or consultant, each must be described separately. (Repeat this section for each contract/consultant.)*

## ITEMIZED CONTRACTOR(S)/CONSULTANT(S)

*Provide a list of contractors/consultants, detailing out the name, hourly/flat rate, and overall cost of the services performed. Please note that any statutory limitations on indirect costs also apply to contractors and consultants.*

| # | Name/Organization | Hourly Rate/Flat Rate | Funds Requested |
|---|---|---|---|
| 1 | | | |

**Contractual/Consultant Subtotal: $0.00**

## CONTRACTUAL JUSTIFICATION

*Provide for each of your real or anticipated contractors listed above a description of the project activities each will accomplish to meet the objectives and outcomes of the project. Each section should also include a justification for why contractual/consultant services are to be used to meet the anticipated outcomes and objectives. Include timelines for each activity. If contractor employee and consultant hourly rates of pay exceed the salary of a GS-15 step 10 Federal employee in your area, provide a justification for the expenses. This limit does not include fringe benefits, travel, indirect costs, or other expenses. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Contractual and Consultant Costs for acceptable justifications.*

| Contractor/Consultant 1: | |
|---|---|

## CONFORMING WITH YOUR PROCUREMENT STANDARDS

By checking the box to the right, I confirm that my organization followed the same policies and procedures used for procurements from non-federal sources, which reflect applicable State and local laws and regulations and conform to the Federal laws and standards identified in 2 CFR Part 200.317 ☑ through.326, as applicable. If the contractor(s)/consultant(s) are not already selected, my organization will follow the same requirements.

## OTHER

*Include any expenses not covered in any of the previous budget categories. Be sure to break down costs into cost/unit. Expenses in this section include, but are not limited to, meetings and conferences, communications, rental expenses, advertisements, publication costs, and data collection.*

*If you budget meal costs for reasons other than meals associated with travel per diem, provide an adequate justification to support that these costs are not entertainment costs. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Meals for further guidance.*

| Item Description | Per-Unit Cost | Number of Units | Acquire When? | Funds Requested |
|---|---|---|---|---|
| Graduate student fee remissions | $22,121.00 | 1.0 | September 30, 2023 | $22,121.00 |

**Other Subtotal: $22,121.00**

### OTHER JUSTIFICATION

*Describe the purpose of each item listed in the table above purchased and how it is necessary for the completion of the project's objective(s) and outcome(s).*

Graduate student fee remissions: Graduate Fee Remissions are budgeted in accordance with university policy.

## PROGRAM INCOME

*Program income is gross income—earned by a recipient or subrecipient under a grant—directly generated by the grant-supported activity or earned only because of the grant agreement during the grant period of performance. Program income includes, but is not limited to, income from fees for services performed; the sale of commodities or items fabricated under an award (this includes items sold at cost if the cost of producing the item was funded in whole or partially with grant funds); registration fees for conferences, etc.*

| Source/Nature of Program Income | Description of how you will reinvest the program income into the project to enhance the competitiveness of specialty crops | Estimated Income |
|---|---|---|
|  |  |  |

**Program Income Total: $0.00**

**Timeline**

Even though the beginning timeline of this grant does not align well with the harvesting season in Indiana, we will be able to start immediately on this project.

In Y1Q1, we will start designing our system with some already recorded videos of washing lettuce and other leafy greens at the Purdue Student Farm. These videos were recorded during 2019 and 2021 using two different sets of cameras, for over 60 hours of activities. The previously used camera systems are not identical to our proposed multi-camera system, but they will enable us to begin exploring the ability of different camera locations to observe the key actions of food-safety plans for post-harvest processing of lettuce.

In addition, we will procure new cameras and begin designing and installing the proposed camera system for this project.  Multiple cameras will be installed to enable us to explore which locations provide the most consistent and informative view for the proposed task.

Also in Y1Q1 and Y1Q2, we will perform a literature review of action detection and recognition methods, focusing specifically on human activities and on human-to-object interactions. We will build out the video processing pipeline and infrastructure in Y1 Q1 and Q2. We will also design and prototype our user interface for communicating with post-harvest workers about what are the required steps and whether or not they have been observed performing them.

In Y1 and Y2, Q3 and Q4, we will systematically and routinely record post-harvest activities of leafy greens and other specialty crops at the Purdue Student Farm, as these crops are harvested. These videos will be backed up and the manual processing associated with designing a video analytics system will begin.

In Y2 Q1 and Q2, we will focus on developing the video analytics algorithm.  In addition, we will refine our user interface based on informal feedback we receive from users during post-harvest in Y1Q3 and Y1Q4.

March 7, 2023

Amy Reibman
Elmore Professor of Electrical and Computer Engineering
Electrical And Computer Engineering
Purdue University
645 Northwestern Avenue
West Lafayette, IN 47907

Re. Support of ISDA SCBG 2023 proposal: **Applying video analytics to document food safety processes and practices**.

To Whom It May Concern,

Student education is the heartbeat of the farm. We believe that teaching the next generation of growers and horticulturists is one vital aspect of sustainability. The Purdue Student Farm was established to provide undergraduate students with hands-on experience in designing and managing a small, sustainable farm. The farm also supports the small-scale farming research of faculty and specialists from several colleges and departments on campus and hosts outreach and Extension events for many groups. One of the highlights of our Extension efforts is the annual Small Farm Education Field Day. This event has become the sought-after summer Extension event for small to medium-sized farm entrepreneurs, master gardeners, and students.

The Purdue Student Farm is dedicated to improving food safety processes and practices on commercial specialty crop farms in Indiana. As such, we support the proposal, **Applying video analytics to document food safety processes and practices**, submitted by Amy Reibman and others at Purdue University to the ISDA Specialty Crop Block Grant Program. The project will address growers' needs concerning documentation and record-keeping of implemented Good Agricultural Practices (GAPs). The proposed research will help growers easily pass a third-party audit that verifies GAPs are followed, which will further reduce the incidence of food-borne illnesses. The Purdue Student Farm is excited about this opportunity to educate specialty crop growers and students.

Please get in touch with me with further questions or to discuss how the Purdue Student Farm can further contribute to this program.

I appreciate your consideration of this proposal.

Sincerely,

*P. Langenhoven*

Petrus Langenhoven
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