# Milestone 1 - Identify a Problem to Solve

Milestone 1 is where you begin working on your course project, a proposal for your own autonomous AI. Your goal is to: propose a use case, describe the value of the problem, and analyze the current system and its limitations.

You may use one of the case studies presented in the course as examples, but we strongly encourage you to be innovative and curious enough to create your own.

## 1 | Use Case Title: Agricultural drones

## 2 | Use Case Overview *(<=100 words) Provide a brief description of the use case and the system that your autonomous AI will improve.*

Agriculture is lifeline of any country particularly for 3rd world countries. Due to shortage of skilled manpower, expensive fuel costs, improvements in agricultural industry are of paramount importance and urgent most need of such countries. AI powered “agricultural drone” can be used in order to spread the seed for new crop over large area, monitoring of crops at regular intervals as well as suggesting and helping provide optimal water to achieve maximum yield with minimum resources.



## 3 | Use Case Value *(<=100 words) Explain the value of improving the performance of this system.*

Even if **10%** of agricultural land is brought under drone based seeding, administration, surveillance etc.. then an annual saving of **USD 500 million** is possible which is a very huge sum of money for a developing nation. Agricultural drone can help monitor the crop yield, seeding interval and seasonal patterns as well as monitoring for entire lifecycle of crop in the form of periodic visual and data based reporting system.

## 4 | Current Methods *Select and explain the current methods used to control or optimize the system*

|  |  |  |
| --- | --- | --- |
|  | **Method** Check all that apply | **Description** |
|  | Human Operator / Engineer | Supervisors guiding their ground team |
|  | Expert System |  |
|  | Control Theory (PID, MPC) |  |
|  | Optimization Techniques |  |
|  | Other |  |

## 5 | Limitations of current methods *Select and explain the limitations of current methods*

|  | **Limitation**  Check all that apply | **Description** |
| --- | --- | --- |
|  | Ability to control well across scenarios / conditions | Extremely difficult to control various direct / indirect costs related to labor training, avoiding wastage of seed, avoid usage of excess fuel for electricity, sub-optimal water usage and other protection of crop methodologies. |
|  | Multiple or changing optimization goals | Not only is there severe shortage of agricultural land, water and fertilizer are also very costly. Optimum use of all is extremely difficult if not impossible for untrained personnel. |
|  | Human Operator /  Engineer Limitations  May include  · Difficulty managing many variables and dimensions  · Difficulty adapting to changing conditions  · Large performance discrepancy between novice and expert operators  · Inconsistency across expert operators | Below are some main challenges / limitations of a normal operator.   * It is not at all possible to monitor crops round the clock * Changing climatic conditions means a huge uncertainty in future course of actions * Best fertilizer per crop combo including even spread is difficult for a normal human operator |
|  | Uncertainty in the measurement of the inputs or the process make it difficult to control or optimize. |  |
|  | Time to develop control or optimization system is prohibitive |  |

**Milestone 1 – Ends Here**

The remainder of this worksheet (Part 2) can be completed after you have finished the “Learning the Solution” module (which includes course items 3.1 to 3.4).

# Milestone 2 - Identify Autonomous AI Components to Use

For this week’s milestone, we will continue working on the proposal for an autonomous AI that you began last week. This week, you will propose an autonomous AI solution, determine which of the components you’ve learned about the system will include, and explain the autonomous AI superpowers that your autonomous AI brain will exhibit.

*You may want to update Sections 1 & 2 with any new insights you’ve gained.*

## 6 | Autonomous AI Overview *(<=100 words) Provide a brief description of how your proposed autonomous AI would improve the process.*

Agricultural drone system “**AgriCopter**” will help automate the process of crop visual condition updates as well as seed spread in the initial stages of crop cycle.

It would be programmed to carry out the autonomous reconnaissance of the whole agricultural field area, prepare a detailed map for next action plan i.e., seed spread in most efficient (least fuel use) way and then execute the planned mission.

The main purpose of this whole autonomous system would be to help automate the whole process of crop seeding, maintenance and harvesting support.

## 7 | Optimization Goal *List and describe the key performance indicators that will define control/optimization of the system (Example: maximize (throughput)*

An improvement of **80-85%** can be achieved compared to current manual methods where manpower and fuel are primary resources.

## 8 | Autonomous AI Components *Select and explain the automation methods your AI will use.*

|  | **Method**  Check all that apply | **Description** |
| --- | --- | --- |
|  | Math (control systems) |  |
|  | Menus (optimization) |  |
|  | Manuals  (expert rules and systems) | General non-expert manpower is still needed for basic day to day activities and initial logistics. |
|  | Machine learning | Machine learning is required to carry out visual surveys as well as understanding the types of various crops. |
|  | Deep reinforcement learning | DRL will be used for mission planning based on the varying conditions. |

## 9 | Autonomous AI Superpowers *Select the superpowers that your autonomous AI brain will exhibit and explain how they will lead to an improvement in the process.*

|  | **Superpower**  Check all that apply | **Description** |
| --- | --- | --- |
|  | Makes human-like decisions | DRL will help arrange the main mission for each flight. It would include the planning for data gathering as well as executing some tasks like seed spread, spraying etc. |
|  | Perceives, then acts | Perception would be visual done through high quality HDR cameras on-board the “AgriCopter”. |
|  | Learns and adapts | Simulation system can be developed in order to train the drone system prior to actual flight in field. |
|  | Spots patterns | Patterns will help the main DRL system plan its next course of action / mission. |
|  | Infers from experience | Inferences can be deduced both from Simulator as well as actual past flight data records. |
|  | Improvises and strategizes | Final strategy is carry out whole mission with minimal expenses as well as use of most optimal flight routes. |