

# PROJECT SCOPE STATEMENT

**Project Title:** Artibot

**Date Prepared:** 26.09.18

## Product Scope Description:

Develop a self-driving autonomous vehicle which can drive in test environment but not in commercial roads.

## Project Deliverables:

### Technical

- Image recognition of road lanes
- Self-driving mechanism

### Documentation

- Requirement Documentation
- Prototype Results
- Test Results

## Project Acceptance Criteria (in scope):

- Recognize road lanes
- Be able to drive between the lanes for 10 seconds or more before it goes out of lane.
- Finish and deliver the Project before May.

## Project Exclusions (out scope):

- Battery
- Real life environment (pedestrians and bicycles)
- Speed and acceleration
- Weight
- Vehicle shape.

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## Project Constraints:

Project constraints are defined by our budget and team.

- The team consist of five members from different engineering disciplines.
- The budget for our project is 154203.5 NOK
- Limited knowledge regarding AI
- Time

## Project Assumptions:

Our team focuses on not developing the car itself but develop the learning algorithm for the self-driving part, which is reinforcement learning. We will use image recognition to detect the lanes and not develop an algorithm for object detection.

| <i>Key Stakeholders</i>                   |   |
|---|---|
| Stakeholders                              | Description   |
| Employer/The Product Owner; Aurilla A. A. | Direct source of the key requirement                                    |
| USN                                       | Makes regulation and rules for the development of the project to follow |
| Artibot                                   | The development team for the project                                    |
| Investors/sponsors                        | Provides the financial investment to the project                        |
| Suppliers                                 | Provides the equipment and components of the product                    |

# Project Artibot

## Physical resource:

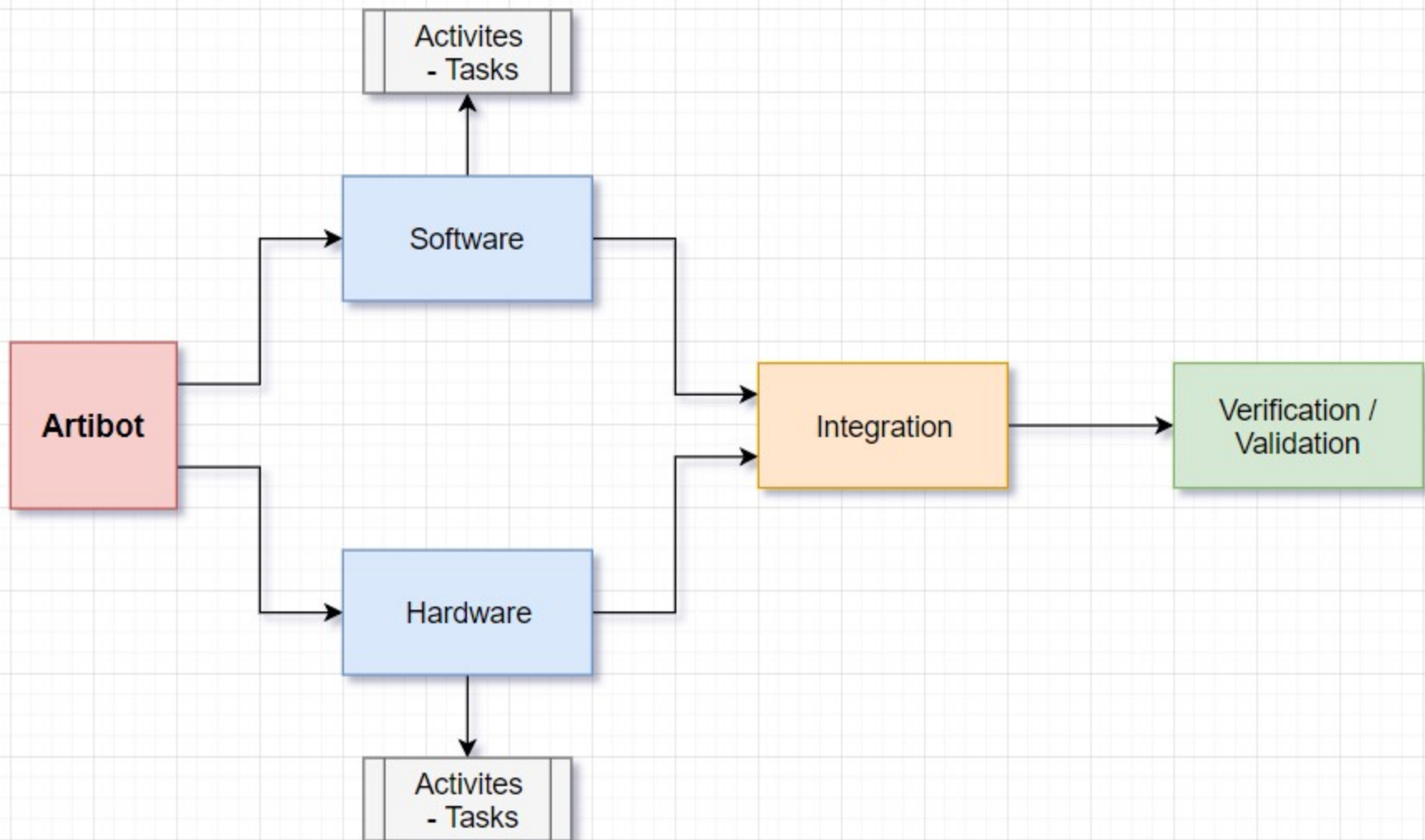
- Lab car prototype.
- Rechargeable Batteries
- Personal PC's
- Jetson TX2
- On board camera
- Sensors
- 2x GTX 1070

## Software resource:

- Anaconda
- Matlab
- Visual studio
- Tensorflow
- Keras
- Sharelatex
- Github
- Ubuntu

## Human resource

- Development team
  - Huseyin (SM)
  - Bozhao (Ar)
  - Chrisander
  - Bilgehan
  - Eivind (APO)
- Supervisors
  - Pr. Aurillia
- Consultant:
  - Pr. Dag
  - Pr. Antonio
  - Pr. Tad
  - Pr. Kiran
  - Pr. Bhuvan



# RISK MANAGEMENT PLAN

**Project Title:** Artibot

**Date Prepared:** 27.09.18

## Methods and Approaches:

Risk Analysis

## Tools and Techniques:

- Risk Analysis Matrix
- Characteristics: Probability, Severity and Impact.
  - The Impact describes the level of risk and is calculated in the matrix by  $\text{Probability} * \text{Severity}$ .

## Risk Categories:

- Human factors
- Business
- Technology

| #  | Risk                   | Description  | P | S | I  | Mitigation   | Action to take   |
|----|------------------------|--|---|---|----|--|--|
| 01 | Computer crashing      | Likelihood of any computer we use crashing                                   | 1 | 5 | 5  | Work on more than a single computer  | Computer needs to be repaired immediately, and we need to continue to work on another computer |
| 02 | Testing environment    | No environment to perform the testing  | 3 | 4 | 12 | Apply room as early as possible  | Rent a commercial rental room  |
| 03 | Data loss              | If the project documents gets deleted or corrupted                           | 1 | 5 | 5  | Backup of all documentation in either Google Drive, Local hard drive, etc. | All documentation must be rewritten as fast as possible  |
| 04 | Absence                | Absence of a team member   | 5 | 2 | 10 | Make sure that we are not too dependent of a team member                   | Notify the other team members and divide the tasks   |
| 05 | Lack of knowledge      | Team member lacks technical knowledge to implement a system                  | 4 | 2 | 8  | Make a plan on which materials we need to learn beforehand                 | Ask other students/teachers and start learning the insufficient knowledge from the internet    |
| 06 | Global standard        | The car provided by the school might not follow the global standard          | 3 | 4 | 12 | Buy components that is following the same certain standard                 | Buy interface to adapt to the predefined standard  |
| 07 | Poor requirements      | Stakeholder or system requirements might change                              | 3 | 3 | 9  | Apply Scrum methodology to be agile  | Refine the product backlog and add the new requirements  |
| 08 | Computer compatibility | Software do not support the computer you use                                 | 2 | 3 | 6  | Read the system requirements of the software                               | Find a new computer that supports the software   |
| 09 | Budget                 | The project's cost exceeding the budget given by the investors               | 4 | 2 | 8  | Create a good budget plan and make sufficient research of components       | Negotiate for a higher budget  |
| 10 | Group dynamic          | Disagreement within the group regarding project and poor working environment | 5 | 4 | 20 | Have a transparent environment and active communication                    | Scrum master call an additional meeting to resolve issue                                       |

Table 1: Lists of risks

P. = Probability, S. = Severity, I. = Impact

| Impact  | Risk                |
|---------|---------------------|
| 1 - 3   | Minor risk          |
| 4 - 7   | Low risk            |
| 8 - 12  | Moderate risk       |
| 13 - 18 | High risk           |
| 19 - 25 | Extremely high risk |

Table 2: Risk categories

|          |   | Probability |    |    |    |    |
|----------|---|-------------|----|----|----|----|
|          |   | 1           | 2  | 3  | 4  | 5  |
| Severity | 5 | 5           | 10 | 15 | 20 | 25 |
|          | 4 | 4           | 8  | 12 | 16 | 20 |
|          | 3 | 3           | 6  | 9  | 12 | 15 |
|          | 2 | 2           | 4  | 6  | 8  | 10 |
|          | 1 | 1           | 2  | 3  | 4  | 5  |

Table 3: Risk matrix



| Three point estimates |                         |          |                 |                  |                  |                    |                    |                |
|-----------------------|-------------------------|----------|-----------------|------------------|------------------|--------------------|--------------------|----------------|
|                       |                         | quantity | Optimistic cost | Most likely cost | Pessimistic cost | Weighting equation | Expected cost est. | total estimate |
| GPU                   | RTX 2080 ti             | 4        | 12000           | 13500            | 15000            | $(OC + 4*MC+PC)/6$ | 13500              | 54000          |
| On board pc           | TX2                     | 1        | 3560            | 4560             | 6000             | $(OC + 4*MC+PC)/6$ | 4633.333333        | 4633.333333    |
| Battery               | ZOP Power 14.8V         | 1        | 250             | 350              | 400              | $(OC + 4*MC+PC)/6$ | 341.6666667        | 341.6666667    |
| Frame                 | RC Car Chassis          | 1        | 700             | 1000             | 2000             | $(OC + 4*MC+PC)/6$ | 1116.666667        | 1116.666667    |
| Motor                 | DC Motor                | 1        | 350             | 900              | 2000             | $(OC + 4*MC+PC)/6$ | 991.6666667        | 991.6666667    |
| Wheels                | Rubber tires            | 2        | 250             | 300              | 450              | $(OC + 4*MC+PC)/6$ | 316.6666667        | 633.3333333    |
| software              | sharelatex/visual sudio | 4        | 15280           | 16880            | 25760            | $(OC + 4*MC+PC)/6$ | 18093.33333        | 72373.33333    |
| Sum                   |                         |          | 114480          | 128930           | 174340           |                    | 134090             | 134090         |
|                       |                         |          |                 |                  |                  |                    | Budget             | 154203.5       |

|           |                                  |             |               |                                  |                      |
|-----------|----------------------------------|-------------|---------------|----------------------------------|----------------------|
| Meetings  | Backlog Refinement<br>Mid Sprint | Daily Scrum | Task Planning | Retrospective<br>(Sprint review) | Sprint Planning      |
| Documents | GitHub<br>ShareLatex             | NA          | GitHub        | ShareLatex                       | ShareLatex<br>GitHub |

Story cards & Visible wall

<https://github.com/Artibot/Autonomous-Car-CHEBB/projects/1>