Self-Driving Cars

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Waterfall Method

Waterfall model plans everything in sufficient details so we can get it right for the first time. It is also referred to as a linear-sequential life cycle model.

It is a very formal process including extensive documentation, Serial execution where it completes each step before starting next and it is very difficult to get back to the earlier stages. At the end of each phase, a review takes place to determine if the project is on the right path and whether or not to continue or discard the project.

Self-driving cars is an example of waterfall model as it is a critical system which require extreme safety or security.

Steps of Waterfall model for Self-Driving Cars:

- Requirement Gatherings: In this step, the specific requirements are gathered and analysed by the team. Requirements are documented during this phase and clarifications can be sought.
- System Design: The architect and senior members of the team works on the software architecture, high level and low-level design for the project. It is decided that self-driving car system needs to have redundant backup and failover capabilities such that system is accessible at all the times.
- Implementation: The development team works on coding the project. They take the design documents and ensure that their solution follows the design finalized by the architect. Since the application is self-driving cars and safety was a high priority in the application requirements, they implement several safety checks in the application.
- Testing: The testing team tests the complete application and identifies any defects in the application. These defects are fixed by the developers and the testing team tests the fixes to ensure that the defect is fixed. Safety testing teams were assigned to test the safety of self-driving cars.
- Deployment: The team builds and install the application on the servers which were procured for the self-driving application.
- Maintenance: During the maintenance step, the team ensures that the application is running smoothly on the servers without any downtime. Issues that are reported after going live are fixed by the team and tested by the testing team.

Advantages of Waterfall method:

- This model is simple and easy to understand and use.
- In this model steps are processed and completed one at a time. Steps do not overlap. The parallel parking module of a driverless car must consider functional safety as the absence of unreasonable risk, including major injuries and even death, due to hazards caused by malfunctioning systems and built-in parts. As a result, every stage of development should undergo thorough and in-depth planning, similar to the waterfall model.
- It is easy to manage due to the rigidity of the model – each phase has specific deliverables and a review process so the changes of getting errors get minimized.

Disadvantages of Waterfall method:

- High amount of risk and uncertainity when safety is the main concern.
- Once an application is in the testing stage, it is very difficult to go back and change something that was not well-thought out in the concept stage.

RUP Model

Rational Unified Process (RUP) is an agile software development methodology. RUP splits the project life cycle into four phases. During each of the phases, all six core development disciplines take place: business modelling, requirements, analysis and design, implementation, testing, and deployment.

The main goal of RUP is to create high quality software with a predictable budget and time frame. Each of the life cycle phases can be repeated, if needed, until the main objectives are met. Once the transition stage is completed successfully, the project is finished.

The use cases and scenario development would help to clarify many of the requirements because the self-driving car project is complex and not properly organized.

Instead of a comprehensive software design, it focuses on reusable component-based architectural design, which works well for building intricate automotive parts separately and also saves time as compared to waterfall model.

There are some limitations too like as it provides risk management support, more dependency on risk management is required and also it is hard to integrate again.

To overcome the limitations of Waterfall model, RUP model is being used as it is developed iteratively.

Advantages:

- It provides good documentation, it completes the process in itself.
- It provides risk-management support.
- It reuses the components, and hence total time duration is less as compared to waterfall model.

Disadvantages:

- Team of expert professional is required, as the process is complex and not properly organized process.
- More dependency on risk management.
- Hard to integrate again and again.

Extreme Programming

Extreme programming (XP) is one of the most important software development frameworks of Agile models. It is used to improve software quality and responsiveness to customer requirements. The extreme programming model recommends taking the best practices that have worked well in the past in program development projects to extreme levels.

For self-driving car project, The XP method is more productive as compared to waterfall method and RUP method by the following measures:

The defects can be reduced to 10% as compared to Waterfall and RUP if we use XP method and Significant increase in staff productivity using the XP approach. Customer Satisfaction is high and the morale of the stakeholders will be high.

Advantages:

- The XP model is very useful in small projects with small teams because face-to-face meetings are easier to arrange.
- This type of project must deal with rapidly changing requirements as well as technical issues. As a result, the XP model is used to complete this type of project.
- Extreme programming allows the software developers to focus on coding and not worry about the unproductive activities related to the project

Disadvantages:

- Customer must participate in the process
- It takes larger time and even cost is high as compared to waterfall model and RUP model.
- This methodology does not measure code quality assurance and it may cause defects in the initial code and XP is not the best option if programmers are separated geographically.