Agile process oriented AI with the CPW Method

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Abstract. How to apply the CPW Method with the CPW Process Method in agile process oriented Artificial Intelligence? This will be shown at an example of mowing a grass field. But first of all the introduction:

1. The responsibility in dealing and interplay with man and machine and their influencing on the environment

Things happen here in this world either in a natural way and manner and on the other side influenced by human beings. But among others there are influenced also things here in this world through man and machine, and we as human beings are thereby challenged to do this as environmentally friendly and sustainable as possible, which not always happens as you can see, however if you have the possibility, you should do this of course, also in responsibility for future generations.

2. The responsibility in dealing with new technologies

The Software world has influenced our life, and made us possible many things, but with every new technology there are also their downsides or negative side effects with their applications, and you hope of course, that they are within limits, because risks or misuse of technologies did already exist, and it is basically not avoidable or even preventable completely. However it is moreover the responsibility of each individual, how to deal with it, but also how we can take influence in our personal

environment, so that technology can be applied in a meaningful manner and are not misused. In some cases the governments have the duty and responsibility, to allow things only in limited way or even to forbid it, if it is required.

3. Progress through Software and their applications

Software helps us to make natural things much more easier. In former times on the type writer and now we are writing on the notebook or laptop. The software which is developed for this, has basically natural processes and procedures and is described with sequence as sequence of steps, selection as decision to certain criteria, whereby the decision can be Yes or No, but also can be expressed with logical operators, operations and logical links with different criteria. The consequence of the decision are Yes or No, either or, and at a logical operation then also either or but also both together and other logical operations (XOR, OR, AND, NAND,…). The process continues then either sequentiell or parallel in any form. And in addition there are also processes and procedures, which are repeated in form of iterations. The question is of course who decides and how the decision is made?

4. Who decides and how is done the decision?

The man can decide either rational to certain criteria, but the man can also decide emotional, to make the decision based just on his gut feel how the man currently feels.

If a man decides emotional just on whim, then there is it not possible to derive an algorithm or a logic. The man behaves according to desire and mood and from his behavior it is not possible to identify or to derive an algorithm, or logic or a logical operation.

5. A greenskeeper and his mowing task

A greenskeeper from a football club for example drives crisscross over the grass field of the playing field, and mows the grass field as long as until all has been mowed, if that is efficient or not, is anyon's guess, and plays for him not a major role. And how nice or not so nice at the end the grass field looks like, interest nobody, because it is a lower football league, and because there is no football stands, where you can recognize really well the patterns of the grass field. It doesn't matter, the main thing is, the grass field of the playing field is mowed more or less well and the football players can use the grass field and can make their regular training or can make their next game.

6. A confused autonomous robot and its mowing task

For this task you can of course also use a confused autonomous robot, and hopefully forget nothing, and all is mowed, and leave nothing. With the emphasis of confused of this autonomous robot, where no man can recognize while watching, with which algorithm the robot has mowed the field green. The robot drives crisscross over the grass field, and hopefully at the end of the day, the grass field has been really moved, and no grass stubbles are remained. But many robots, which are currently on the market, are not able to do this task in a proper way, as you can see on the picture below.

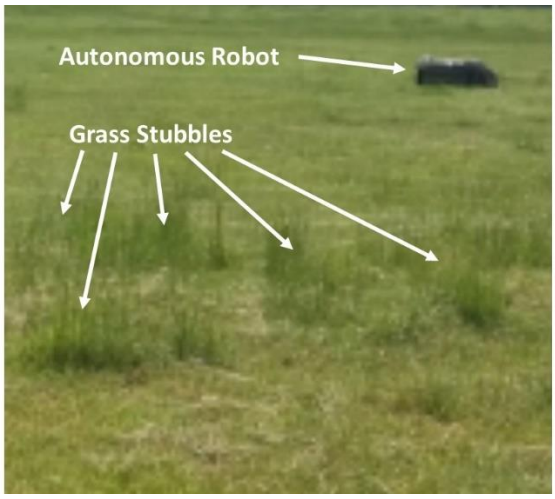

Fig. 1: A green with grass stubbles as a result of an autonomous robot with its mowing task.

7. A greenskeeper and his mowing task – well enough?

The greenskeeper runs in a circle, in a rectangle, from here and there, from left to right, from top to bottom, diagonal, and also crisscross. In all cases the result is almost the same. The grass field is mowed more or less. And is hopefully well enough mowed, so that the grass field is more or less well playable for the football players.

8. A nice mowed grass field with a certain pattern

However a nice mowed grass field has a certain pattern or becomes a certain pattern in which direction the grass field is mowed. You can see this at a grass field of a playing field. Have anyone ever seen a grass field of a first premier league, where the patterns of the grass field are crisscross. No, probably not. Most offen the stripes of the grass fields are parallel arranged to the goal lines. Although it has no mayor influence on a football game, it has become usual practice, that the grass field of a football field is prepared from a greenskeeper like this, that the stripes of the grass field are arranged parallel to the goal lines. The reason for dark and light stripes are therefore, because the lawn mower presses in the driving direction the grass down. Therefore the grass field appears in driving direction of the lawnmower darker and against the driving direction appears the grass field rather lighter. In the meantime there are also recommendations or rules from the German Football Association (DFB) in Germany [6], and also from the UEFA (Union of European Football Associations) for Europe [7,8,9], how should be the appearance of a mowed grass field of a playing field for a football game.

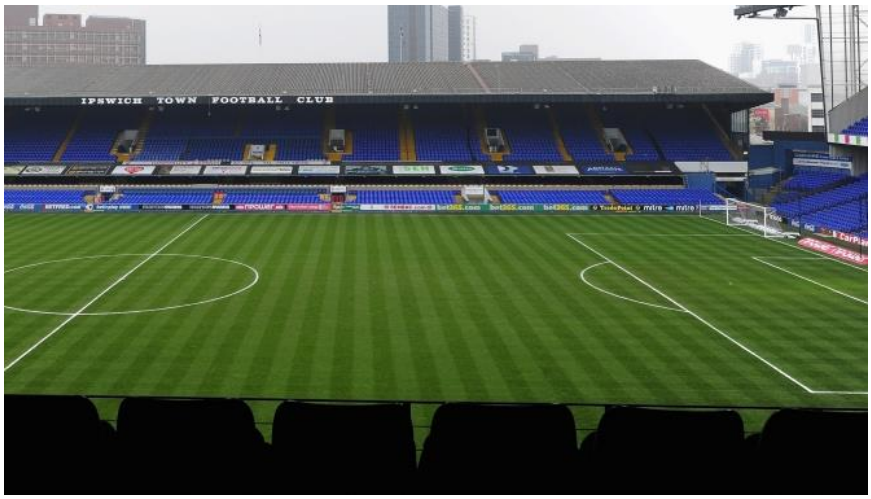

Fig. 2: German Football Association (DFB)
Football Grass field Guideline [7].

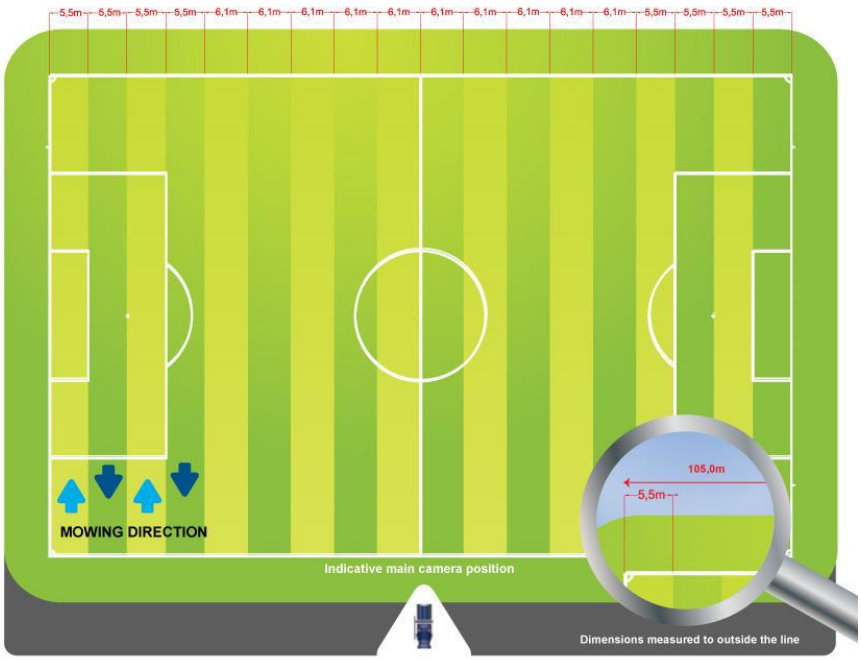

Fig. 3: UEFA (Union of European Football Associations)
Football Grass field Guideline [8].

Fig. 4: Camp Nou Stadium FC Barcelona (Barcelona) [9].

9. A confused autonomous robot and its trial of mowing a grass field with patterns

In case a robot would mow more or less crisscross in a wild confusion the grass field, but at the end you see not a nice pattern of the grass field, many people would say: How looks like the grass field? What happens here? What has here done the greenskeeper? Has the greenskeeper perhaps drunk too much or he was even drunk?

10. Finding out the mowing method of a grass field with stripes

To mow the grass field like this, how it should looks like with stripes, it needs a certain method, and if it is possible you can derive or identify an algorithm from it. It is the matter and objective to find out or to identify an algorithm. The algorithm can be found out, if you look at the result of the grass field with the stripes, and you think up a possible algorithm, how you have to proceed, so that the grass field at the end

looks like this. However you can also accompany the greenskeeper for one day, and you watch and observe, how the greenskeeper mows the grass field and drives with his lawnmower the lines to and fro.

11. Mowing a grass field with stripes with found algorithm

The found algorithm through watching of the occurrence and event can be at the end the same as the algorithm of the greenskeeper, but the algorithm can be also different, but at the end you have then the stripes from left to right or parallel to the goal lines of the football place. The found algorithm is given over therefore to the autonomous robot, and tries then to solve the respective task, so that the football place and grass field has then the stripes the same as the greenskeeper has done the task.

12. Automation of mowing a grass field with stripes loading a picture by the robot

The further step of automatization would be then, if the robot could load the picture of the grass field with the stripes, how the grass field should look like. And then finds out thereby independently and autonomous the appropriate algorithm, how the grass field while mowing should have been driven, so that at the end it looks the same as the greenskeeper has made the task. And the greenskeeper makes already this for years to the satisfaction of spectators, television viewers and of course the players.

Thereby there are also some further criteria at the load of the picture, how the grass field with the respective stripes should look like. On the picture are mentioned concrete metrics, how the stripes on the grass field of the playing field should look like, and in which direction the lawnmower robot should drive, so that there is also predefined, which stripes are dark in driving direction, and which stripes are hell in opposed driving direction.

13. Automation of mowing a grass field with stripes where the lawnmower robot has an antenna with camera

A further variant would be also possible, whereby this variant is not all that easy, if the lawnmower robot has an antenna with camera, which is high enough, so that the lawnmower robot can scan the complete playing field. That presupposes however that the shades of the stripes are exist from the last football game, so that the lawnmower robot is able to identify or to derive the algorithm, to mow the grass field with the stripes parallel to the goal line, so that also here the result should be the same as the greenskeeper has made it. The question is also here, whether the robot can scan with the camera at the starting point the complete grass field, or the robot has to drive over the complete grass field with the camera before, to identify and to recognize the patterns of the stripes, to find out the necessary algorithm. It would be better if the robot can scan the complete grass field with the camera at the starting point. Or the robot can scan 10 meters at the starting point for example, and then the robot drives step by step from one side of the playing field to the other side of the playing field.

14. The Robot located in an environment and in a situation to solve the task

The robot has a starting point. The robot or in this case the lawnmower robot is located in an environment and in a situation and should solve a task. For this the robot needs an approach and method. The approach or the method is either predefined, where the robot gets the necessary predefined algorithm at the starting point, or the robot can load a picture with concrete metrics, how the grass field with stripes should look like, from which the robot can derive and identify the method in form of an algorithm. Or then with this following variant. The robot has a sensor or a sensor technology in form of a camera, with which the robot can scan partly or the complete playing field and grass field from the starting point, and is able to find out then independently and autonomous the algorithm, so that the robot can solve then

the task accordingly the same as the greenskeeper, which do this very well to the satisfaction of all.

15. Robot solves the task in a certain environment

In which way and matter how the robot has to solve the task in its environment and with the possible algorithm is in a way predefined through the certain environment. In this case is the environment the football grass field or the playing field, and where the task has to be solved, to mow the grass field like this, how the current patterns of the football grass field with the stripes exist from the last football game. In this case it would be then the third variant, where the robot at the starting point partly or complete can already scan the grass field with a camera, to find out the necessary algorithm.

16. Execution of the task and react to special events

And now it comes during the execution of the task to special events. A small dog is located on the playing field or even children. The robot is able to perceive and to identify a dog or children or also adults. If the dog or the children or adults are coming closer to the robot and the distance is less than 3 meters, the robot stops automatically, and only then continuous and drives further, if the small dog, the children or the adults are going away to a certain distance. There are additional events, which have to be identified in realtime during the execution of the task. The robot has to be able to perceive and to identify the possible events in realtime with sensors and sensors technology. And what ever happens or occurs, the robot has to be able then to react to this events.

17. Lawnmower has to cover all possible events

At the end the lawnmower robot has to cover all possible events, which can happen, so that the task can be excecuted according to the security regulations, and it doesn’t

come to unexpected and unwanted behavior of the robot and even to accidents. Because the reality with possible occuring events can be very complicated, and not all events are covered through the robot, it recommends in some circumstances that the robot can carry out the tasks only under supervision of persons. To what extend here is required a duty of supervision within the frame of the security regulation has to be proved by the appropriate approval institutions and bodies.

18. How can be applied the CPW Method with such examples?

Describing all process steps of the end to end processes with the CPW Process method until the task of the robot is completely solved

At first all process steps of the end to end processes from starting point of the first process step until the last process step are described and documented with the CPW Process method [1,2,3,4,5], until the task of the robot is completely solved.

Creation of one to several Logical Layers for each given task of the robot

For the description of the end to end processes with the CPW Process method [1,2,3,4,5] are created specially each one to several Logical Layers for the given task of the robot, to mow the grass field of the playing field according to the regulation. Thereby can be created the following Logical Layers:

A Logical Layer for example, where the alogrithm can be predefined, to mow the grass field of the playing field accordingly.

A Logcial Layer special for the loading of pictures, with which the robot according to the template through the picture can mow the grass field of the playing field, how the grass field looks like on the picture. Picture 1 would be then for example a picture of the grass field of the last game as a template. Picture 2 would be the template

through the German Football Association (DFB) (German governance body for football) [6]. Picture 3 would be the template through the UEFA (Union of European Football Associations) (European governance body for football) [7,8,9].

A further Logical Layer, where at the starting point partly or even the complete grass field can be scaned in realtime with the camera of the robot, to find out the necessary algorithm, how the robot have to drive the lines of the grass field, so that the patterns of the stripes on the football grass field looks like the same as the greenskeeper would solve the task.

Creation of Logical Layers for each possible event to process the Perception, the Cognition, the Decision Process to react to the events and to act until the robot has solved the complete task

Then for each possible event, which can occur, and which the robot can perceive and identify, a Logical Layer is created with the CPW Process method [1,2,3,4,5]. Which criteria are crucial then, to perceive with the perception possibilities and the existing sensor technology of the robot, the events with things, people, animals and objects in situations in their environment? And then with these perception results, with what the robot has identified and recognized, the robot can then derive the cognitions. And then the robot can decide from the cognitions, how the further approach, method or action is, so that the robot can react then on one side to the event, until the event is then closed, or is under control, so that the robot can then continuous again, so that the robot can solve the complete task.

Solving the task with the CPW Process Method and with Logical Layers

Description of the end to end processes with the CPW Process method for solving the tasks with variants and with available Logical Layers and also with the described

processes for occoring events with perception, cognition, decision process to react and to act until the robot has solved the complete task

With the described end to end processes with the CPW Process method [1,2,3,4,5] is on one hand described the solving of the task with the appropriate variants and possibilities and the corresponding available Logical Layers. But furthermore are also described the processes, which possible occurring events can happen, where then the robot has the possibility to perceive the possible occurring events with the appropriate sensors. To derive then from the perception results the cognitions. So that the robot again can decide with the help of the cognitions, how the further approach, method and actions is, until the event is either closed, or under control. So that the robot can continuous again, until the complete task is solved, und the whole process can be closed.

End to End Processes with the CPW Process method described with a Process Tool

On the one hand the end to end processes with the CPW Process method [1,2,3,4,5] can be described with a Process Tool. Furthermore in the process steps of the CPW Process method are embedded the respective different Logical Layers on one side to solve the task with the different variants, and also in addition the described possible occurring events with the respective Logical Layers, where then at the occurring of possible events the robot can react or the robot has to react, so that the robot can fulfill all security regulations accordingly.

End to End Processes with the CPW Process method applied in an intelligent Workflow engine of the robot

The whole can be realized also as an intelligent workflow engine of the robot, where then the robot functioned as an intelligent workflow engine, and where the end to end processes with the CPW Method [1,2,3,4,5] are applied in an intelligent Workflow Engine of the robot. Whether you name the robot as a robot with artificial intelligence

or than the robot with natural intelligence, is in the margin of discretion of the viewer and of the spectator, where the spectator looks at the lawnmower robot, how the robot solve the task, and hopefully can react to the respective occurring events accordingly.

19. Grass field is not a football grass field but a playing field of American football. What happens then?

Is there not the case that the grass field is mowed of a football grass field, but of a playing field of american football. What happens then? How is then the approach and the methods? The approach is quite similar. Many Logical Layers are almost perhaps the same or similar, and they have to be only adjusted. However there are additional Logical Layers with additional algorithms, because the pattern of the grass field for example at the American football is different. Furthermore it can be, that there are in the USA other events, which can occur possibly on the playing field and grass field, which in Europe doesn't normally exist.

20. Playing field of American football - Approach similar but environment has changed!

The approach or method is similar, but the environment has changed. Before a football grass field in Europe with the task to mow the grass field with stripes parallel to the goal lines. And now an American football field in the USA with another pattern of the grass field [10,11,12]. It needs partly other Logical Layers with other criteria and other algorithms, because the task is different in the execution and operation among others because of the different patterns of the grass fields of the football playing field and American football playing field. And furthermore is the environment not Europe, but USA at the American football, and for this reason it can happen to other events, where then the robot has to be able with its sensors and intelligence to identify and to perceive the possible occurring events. And then to derive in realtime the cognitions from the perception results. So that the robot can decide how the further approach is, so that the robot can react to the events according to the security regulations, until the event is either closed, or it is under control, so that the robot can continuous again until at the end the task is solved completely.

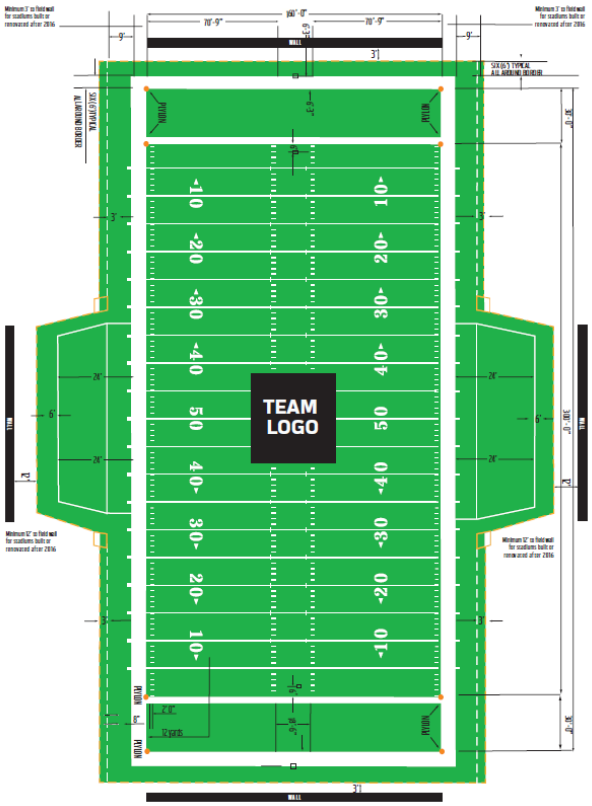

Fig. 5: 2019 official playing rules of the National Football League Rules for the field [10].

Fig. 6: Bank of America Stadium Carolina Panthers (Charlotte,NC) [11].

Fig. 7: Hard Rock Stadium Miami Dolphins (Miami, FL) [12].

21. Question to the security regulations

Here is again the question to the security regulations. Is a duty of supervision required of the autonomous robot, because the robot with his possible behavior cannot cover all possible occurring events. And furthermore is also the question, if it makes sense, if a kind of control center can take the control over the robot at the execution of the task at each point of time by means of a remote control. In addition the control center has also the possibility either to observe the robot at sight, or with the cameras in the stadion, or with the cameras, which are on the robot, to watch and monitor the behavior of the robot and the possible occurring events, in order to enable intervention, if it is required.

22. What is technical possible and where is required a supervison through the man to fulfill the security regulation?

The question is always what is technical possible? To what extent an autonomous robot is really able to solve alone a task, and can also react to the respective occurring events accordingly? And to what extent is required a supervision or even a possible intervention through the man, so that the security regulations are fulfilled, and it doesn't come to unexpected and unwanted situations or even to accidents?

23. Conclusion

The process oriented AI with the CPW Method [1,2,3,4,5] can be applied in Robotics as described in the example, where the CPW Method with the applied logical layers have been applied for a robot, which has to solve the tasks, but also can react to occurring events. With the end to end processes with the CPW Process method [1,2,3,4,5] and with the appropriate logical layers are described the perception, cognition and decision processes for the necessary actions, so that the robot can react to the occurring events on one side, but also to solve the complete tasks.

The process oriented AI with the CPW Method [1,2,3,4,5] can be also applied in Process Automation, Business Process Automation and Robotic Process Automation (RPA).

And in addition can be applied agile process oriented AI with the CPW Method and with the application of logical layers with process modeling [1,2,3,4,5] also in Business Engineering and Business Process Reengineering [6].

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