User Manual of

The Early Warning Plugin of Ponding

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Part 1 Insights

We notice that in UC-winRoad, there are varies of weather mode, which are quite lifelike. However, in our real life, continuous torrential rain may bring on severe flooding.

It might not common in Japan, but in China, things are different. Due to the defective drainage system, it is easy to pond. Some of drivers were not familiar with the state of roads when roads were covered with water. They could not know how deep the pools were so they just drove ahead thus they drove themselves in danger.

We aim to develop a plug-in in UC-winRoad to imitate such kind of situations. When the driver drives, the system will detect the state of the road, display the related data and give warning when the car approaching the dangerous area.

Part 2 Instructions

2.1 User Guide

1. Copy “PondingWarningPlugin” to the directory “UC-winRoad Data 11.1/Plugins”, as it shown in Figure 1.

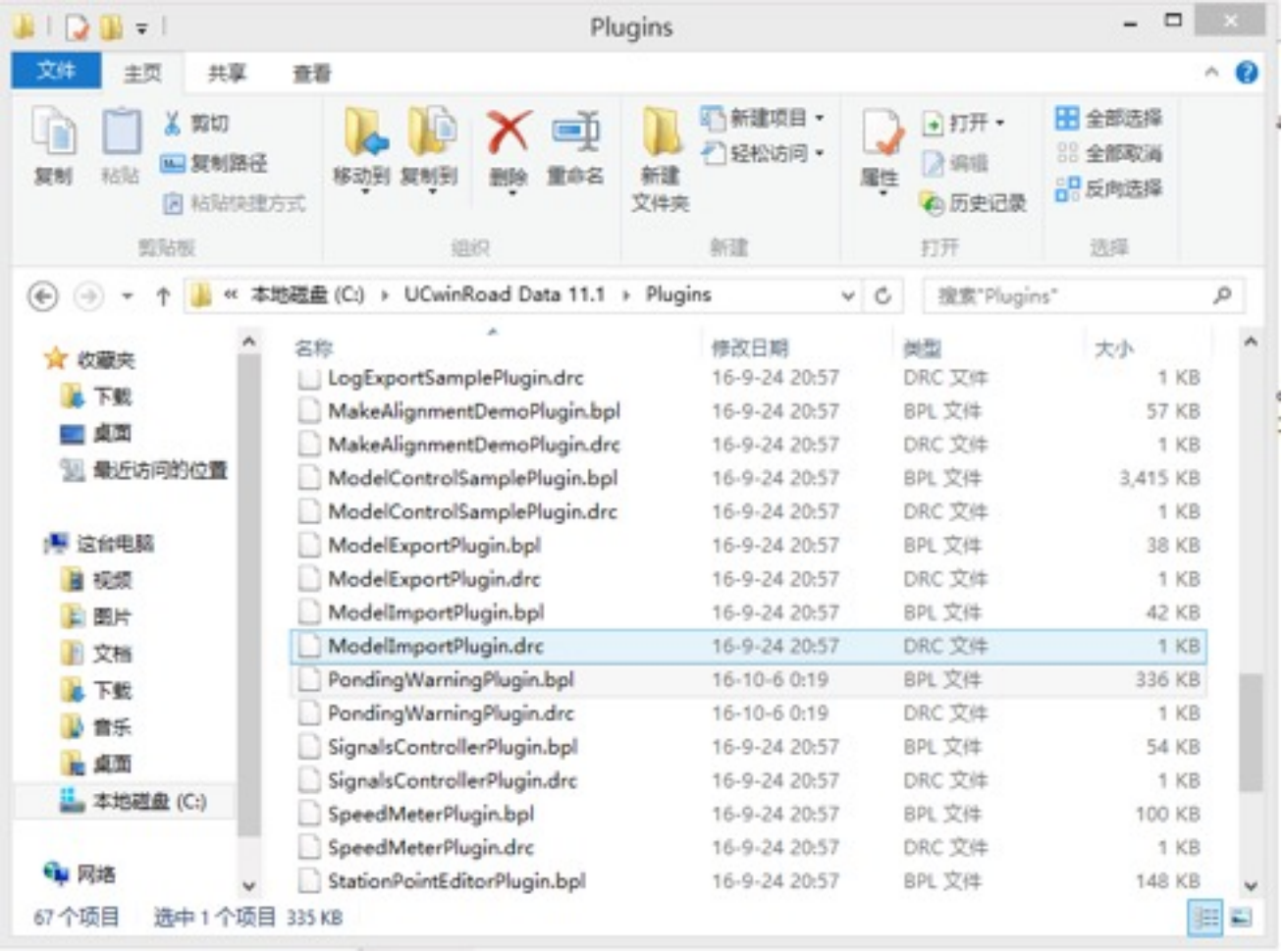

Figure 1

2. Open UC-winRoad 11.1.

3. Click menu “File -> License Manager -> User Plugins”.
   Make sure the plugin having been chosen, then click the button “Authenticate and Close”, as it shown in Figure 2.

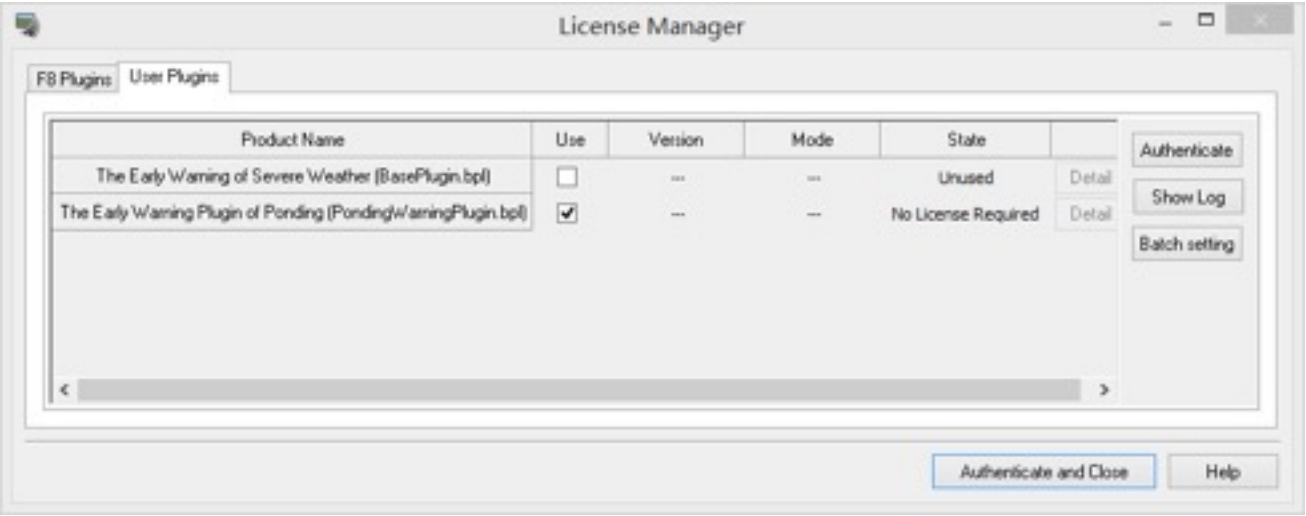

Figure 2

4. You can either start to create a new project or use the saved roads. If you choose to create a new project, you should build some roads on the map first.

5. Click menu SDK Plug-in, Click the button Pond Warn Settings, as it shown in Figure 3.

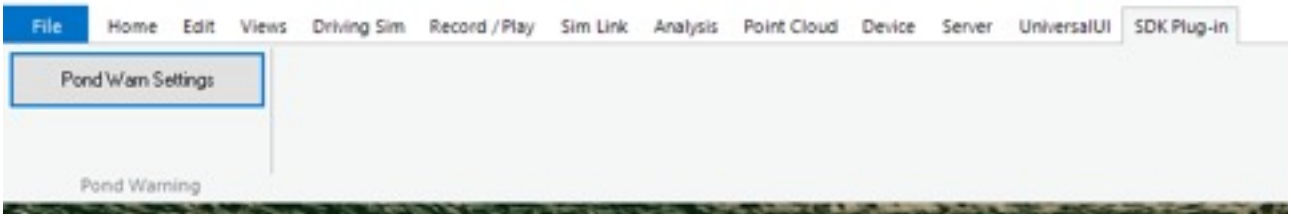

Figure 3

6. You can set different values and choose what datas to be displayed on the panel. The meaning of each item is written clearly, please read them before you change some of values, as it shown in Figure 4.

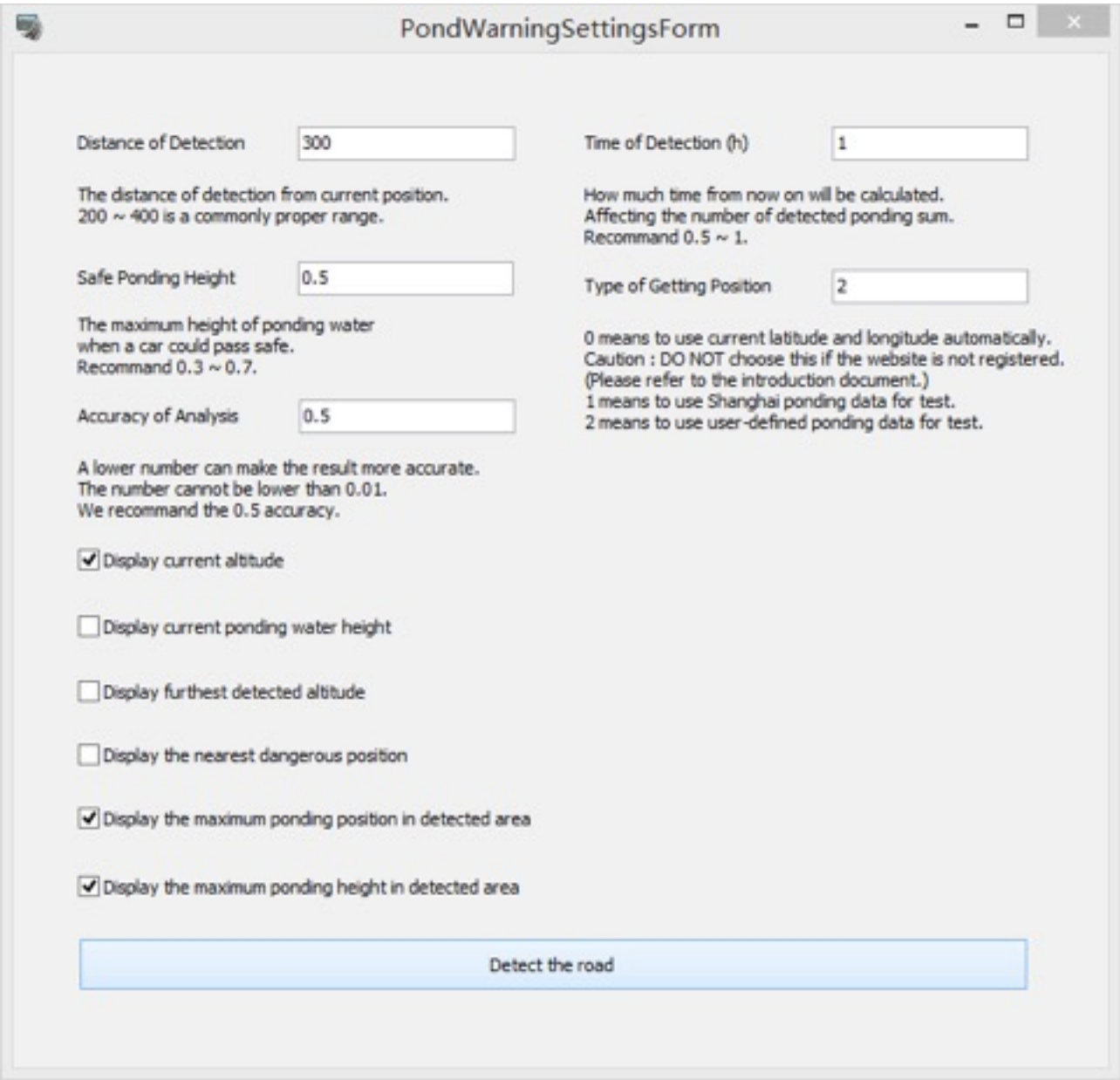

Figure 4

7. Read 2.2 Attentions, make sure you can run the plugin in correct way. Then click menu “Home”, choose drive mode and choose the route.

8. When driving under the normal and safe circumstance, the color of the words should be white, as it shown in Figure 5.

Figure 5

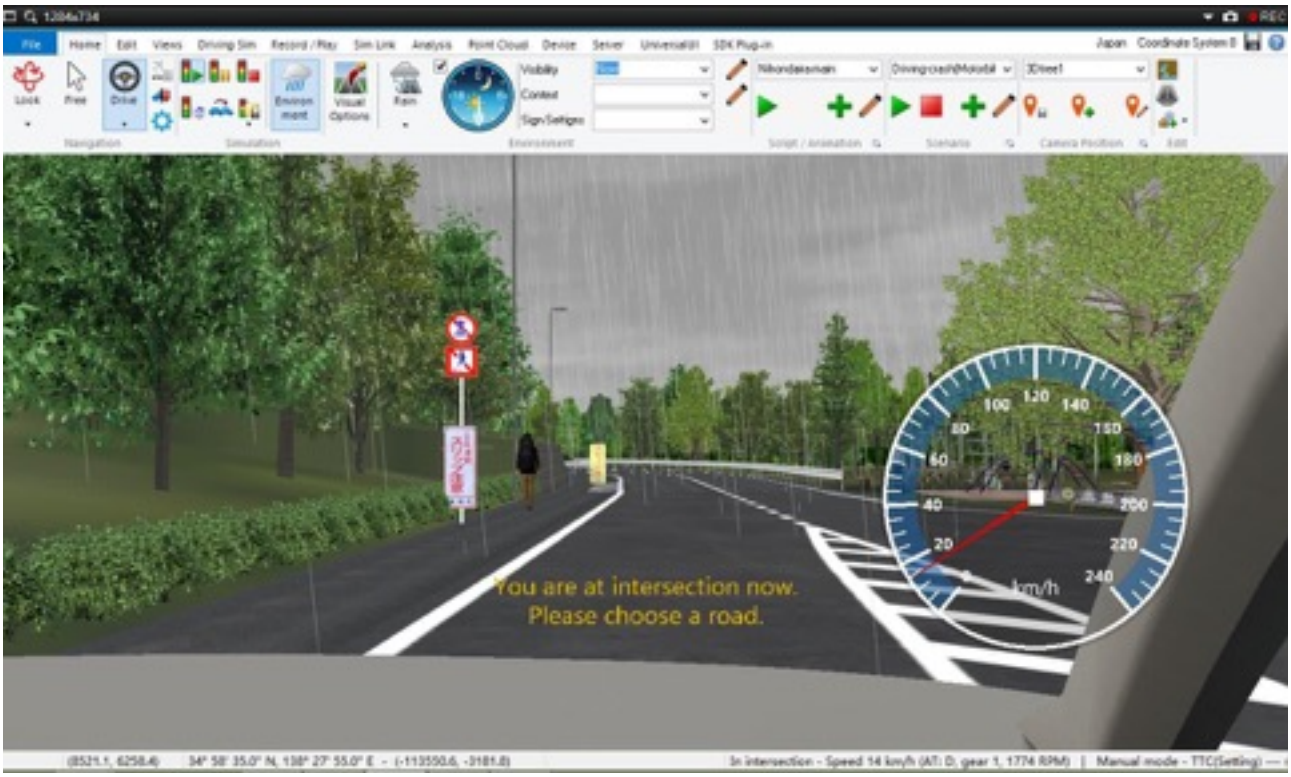

Figure 6

In the UC-winRoad, it is defined that the intersection does not belong to any roads. So when you pass the intersection, no data would be displayed, as it shown in Figure 6.

When the system detect there were a dangerous area of ponding, the color would turn orange, you should turn around as early as you can, as it shown in Figure 7.

Figure 7

But if you insist to drive ahead, which may lead to the car drown or driver and passengers' life lost, the color would turn red, as it shown in Figure 8.

Nearest dangerous position is in 0.0 m.
Max height position is in 0.0 m.
Max height is 69.9 cm
km/h

Figure 8

2.2 Attentions

1. Don't drive against traffic! This plugin cannot give values correctly when the car is retrograding.
2. The website providing Json file which contains weather information is not free. We chose to use a 15 days trial version, and when you open this document, maybe it will expire. This might influence the weather detecting based on latitude and longitude. If this happens (Weather detecting type is 0, and the return value displayed is 'Invalid'), please contact us. We will register another user account to let it work.
3. Don't separate one road to a lot, also don't combine many roads to one. Because what we really detect is one single road at one time, when the road number is changed, the detector will be initialized, so the result will probably not be true(eg: The sample map 'Highway.rd', in which some combined road will return a wrong detection result).
4. Don't create too many roads. We limit the number of roads to 200, and we can save 10,000 limit structs, so don't create a very long road either.
5. As far as we implement, the plugin processes the data of the weather forecast in a certain time which you can set the precise value. So the warning is just a notice based on forecast but not the present situation. Even if you drive in the flooded area, it could be ok.

Part 3 Implementation

We just list some main functions and procedures.

- InitOfRoadAnalysis

  This is to analyze all the roads in project to find every limit points, using in the detection all roads button.

  We consider 4 kinds of different conditions:

  1. A point is higher than its two neighbors.
     It is a maximum limit point.
  2. A point is lower than its two neighbors.
     It is a minimum limit point.
  3. A point is higher than its right neighbor,
     and it is equal to its left neighbor.
     We rule it as a maximum limit point.
  4. A point is lower than its right neighbor,
     and it is equal to its left neighbor.
     We rule it as a minimum limit point.

  In this way, we can ignore the other kind of knee points. This procedure will save these limit points into different struct arrays. And in this algorithm, maximum points and minimum points must appear alternately.

  Reason:

  The first one must be a maximum point:

  1. If starting on a downhill, the most left point is the maximum;
  2. If starting on an uphill, the maximum point must appear earlier than the minimum one;
  3. If starting on a flatland, the most left point is the maximum (referring to InitOfRoadAnalysis) .

  So the minimum[i-1] must between maximum[i-1] and maximum[i].

  Last but not least, this procedure also think about some edge situations such as the last point.

- ## ButtonClick & EditChange & FormVerticalCurveEditorShowEvent & FormVerticalCurveEditorCloseEvent

  These four procedures devote to detect the terrain and fit the road to it. They will run if the button's clicked on road setting menu.

- ## PaintHUD

  The loop procedure which detects the current state of main car.

  Also do some light judgement and choose, such as get the weather-acquiring type, judge if the car’s at intersection, judge the direction and so on.

- ## DetectEveryPoint

  For each point in detecting area, this can calculate a ponding and transport it back to do comparison.

  It firstly calculate the ponding water at L now, then do the judgement.

  if pon=-1:
  No register for Json provided website.
  Please refer to the 2.2 Attentions to get the solution.

  if pon= -2:
  Current maximum ponding is 0.
  There's not raining at all.

  Then, this procedure will set a nearest-ponding-position flag if there's indeed ponding in detected area.

  And if the ponding is not dangerous, the nearest flag won't be set.

- DrawInfo

  This is for the different information display and judge if the ponding water is dangerous.

  If true at current place, the display color will turn to red.

  If detecting dangerous area, the color will become orange to warn the driver.

- CurrentAltitude

  Get the altitude, ponding, distance along road and state for current car.

  Then returns a struct of current basic informations.

- CalculatePond

  This function use our ponding algorithm to calculate the ponding on a single road.

  The algorithm can be separated in 3 preparation parts and 1 judgement part. The preparation parts are:

  1. Judge if there's limit points. If no, return zero.
  2. Judge if there's limit points forwards or backwards. If no, return zero.
  3. Otherwise, compare position, find out two nearest maximum points and the altitude-lowest minimum 'min' between them.

  Then there's a loop of function. It is a complex one which cannot explain clearly in few words, I prefer just list some of them.

  (LoopPlace). If precipitation < lower maximum point - min
  ponding = precipitation - (current altitude -min), return.

else, fetch the next struct in the previous direction of moving in array to replace the original one. If there's no next one, calculate, return. Else, if the lowest is the previous lowest, go to (LoopPlace); ...

There's another three layers of judgement, maybe it makes no sense to list them all here. Our code can make you understand it better if you are interested in it. Also, if you have any questions about this part, please contact us at any time.

- JudgePrecipitation & GetWeather & ConnectNeededDataWebPage

These are functions to get the Json file.

After get the file, they would translate the weather info into precipitation.

We've done the connection in these functions, so if there's any Json file which straightly includes precipitation, the call will be very easy.

Part 4 Contacting Us

If you have any problems with the plugin, we are pleased to receive your feedbacks !

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