













Fig. 11 – Processed cells comparison between 3 algorithms

## VI. CONCLUSION AND FUTURE WORKS

Nowadays, there are many developed path-finding algorithms. The A\* is one of the most used one in many fields. Until now, there are many version of A\* such as IDA\*, D\*, LPA\* and Theta\*. In the Theta\* algorithm, the solution path is more natural, faster but less optimal than weighted h-values version of Theta\*. In our experiment, we found a method to increase the performance by applying the dynamic weights, hierarchical method and equal condition. As the result of our experiment, we find that our modification way make the path-finding process run faster but sometimes more optimal than Theta\*. Applying Dynamic Weight with hierarchical method make improvement on the solution path and computation cost comparing to the Nash et.al's Theta\* Algorithm. In future work, we will apply dynamic weight on different map areas based on its complexity based on the idea of Wilt et.al in his article [18].

## REFERENCES

- [1] Cormen, Thomas H., Leiserson, Charles E., and Rivest, Ronald L., Introduction to Algorithm, McGraw-Hill Companies, Inc. (2009)
- [2] Putri, S.E., Tulus, and Napitupulu N., "Implementation and Analysis of Depth-First Search (DFS) Algorithm for Finding the Longest Path." International Seminar on Operational Research (InteriOR)
- [3] Nash, A., Koenig, S. and Felner, "A. Theta\*: Any-Angle Path Planning on Grids," In Proceeding of the AAAI Conference on Artificial Intelligent. (2007)
- [4] Daniel, K. , Nash, A., Koenig, S. and Felner, A., "Theta\*: Any-Angle Path Planning on Grids," Journal of Artificial Intelligence Research 39 (2010)
- [5] SanGrezan, L., Kiss-Iakab K., Sirbu M., "Comparison of 3 implementations of the A\* algorithm," Creative Math. &INF. (2007)
- [6] Xi, C., Qi, F., Wei, L., "A New Shortest Path Algorithm based on Heuristic Strategy," Proceeding of the 6<sup>th</sup> World Congress on Intelligent Control and Automation. (2006)
- [7] Magzhan, K., Jani H.M., "A Review and Evaluation of Shortest Path Algorithms," International journal of scientific & technology research volume 2 (2013)
- [8] Freeman, J., "Parallel Algorithm for Depth-First Search," Technical Reports (CIS). University of Pennsylvania. (1991)
- [9] Patel, A., "Variants of A\*". Available online at: <http://theory.stanford.edu/~amitp/GameProgramming/Variations.html> (April 11th, 2015 11:00am)
- [10] Stein, E., "ICS 161: Design and Analysis of Algorithms Lecture notes for February 15, 1996," Available online at <http://www.ics.uci.edu/~eppstein/161/960215.html> (April 12th, 2015 13:00pm)
- [11] Robin, "Depth First Search," Available online at: <http://intelligence.worldofcomputing.net/ai-search/depth-first-search.html#.VTBh9KqpBd> (April 13th, 2015 15:00pm)
- [12] Robin, "Breadth First Search," Available online at: <http://intelligence.worldofcomputing.net/ai-search/breadth-first-search.html#.VTeFJtKqpBc> (April 13th, 2015 15:00pm)
- [13] Chamero, J., "Dijkstra's Algorithm As a Dynamic Programming Strategy," Available online at [www.intag.org/downloads/ds\\_006.pdf](http://www.intag.org/downloads/ds_006.pdf) (April 13th, 2015 15:00pm)
- [14] Cui, X., Shi, H., "A\*-based Pathfinding in Modern Computer Games," International Journal of Computer Science and Network Security, Vol. 11, No. 1. (2011)
- [15] Botea, A., Muller M., "Near Optimal Hierarchical Path- Finding," Journal of Game Development, Volume 1. (2004)
- [16] Jansen, R. M., Buro M., "HPA\* Enhancements," AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment. (2007)
- [17] Hansen, A. E., Zhou R., "Anytime Heuristic Search," Journal of Artificial Intelligent Research 28. (2007)
- [18] Wilt, C., Ruml, W., "When does Weighted A\* Fail?" Proceeding of the Symposium on Combinatorial Search (SoCS-12). (2012)
- [19] Nash, A., "Any-Angle Path Planning," Doctor of Philosophy Thesis (Computer Science). The Faculty of the USC Graduate School University of Southern California. (2012)



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