Fuzzy Based Intelligent Control System For Elevator

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Abstract-**This paper presents the idea to make elevator more efficient for user. This project call video based intelligent control system in elevator. This idea use video based intelligent control system to control the elevator at all time and fuzzy logic based expert system for controlling signal at an intersection. The video can monitor and capture picture at all level then send to system to control the elevator. Both are using MATLAB toolboxes for image acquisition, image processing and fuzzy logic. In this paper only focus on the rule base fuzzy logic. The main objective for this idea is to help people to minimize the waiting time for waiting elevator and also to find solution for efficient dispatch system. It contains of two system monitory it from the key dispatching and video camera. To make it intelligent, fuzzy logic in the MATLAB is use to create rule for this system. By developing the video based intelligent control system for elevator, the time for waiting elevator can be minimize. The result obtained from fuzzy logic simulation**

Index Terms- **elevator, video based intelligent control system using camera, camera, elevator control system, fuzzy logic**

I. INTODUCTION

ELEVATOR systems whose complexity makes them difficult to model, analyze, and optimize. In multiple-car elevator systems, particularly those designed to serve large buildings, a major challenge is that of developing a dispatching control policy ,i.e., a scheme for systematically deciding when and where each car should move, stop, or switch direction based on the current state and available past history. While in general, the objective of an elevator dispatching policy depends on the .particular building, for office buildings, the usual goal is to minimize the average passenger waiting time [1]. Achieving this objective is difficult for a number of reasons, including the need to: 1) coordinate multiple cars; 2) satisfy constraints on elevator movement (e.g., a car must stop at a floor where a passenger wants to exit); 3) operate with incomplete state information (e.g., while it is known whether an elevator has been called to a particular floor, it is generally not known how many passengers are waiting at that floor); 4) make decisions in the presence of uncertainty (e.g., passenger arrival times and destinations are uncertain); and 5) handle nonstationary passenger traffic (e.g., for an office building, passenger traffic varies continuously throughout the day, from morning up-traffic, to heavy two-way lunchtime traffic, to evening down-traffic). There have been many researches in this area utilizing numerous approaches in designing the most effective elevator supervisory controller. For instance, C. B. Kim et al. proposed a fuzzy model to determine the area-weight, which is one the important variables in the hall call assignment method. The hall call assignment method assigns a new hall call to the elevator having the smallest evaluation function value among all the elevators. The area-weight is a parameter which affects the evaluation function values of the elevators in the area close to the hall call [2]. In another work, a control strategy generation method and fuzzy elevator group control system (FEGCS) was proposed. The control strategy of FEGCS is made using the classification of the passenger traffic and system manager's requirements, and the hall calls are assigned to suitable elevators by the generated control strategy [3]. R Gudwin et al. introduced a fuzzy group supervisory controller with context adaptation, to accommodate different traffic patterns. Here, context adaptation is to adjust universes in such a way that what is meant to be, e.g., High or Low, depends on the traffic intensity [4]. Besides fuzzy logic, genetic algorithm has also been identified as a beneficial tool in the elevator problem. A. Fujino et al. proposed an on-line parameter tuning method using genetic algorithm, for the floor attribute control method. In this method, the tuning was aimed at minimizing the waiting time and seven control parameters related to multi-objective control which were encoded into the chromosome [5]. Realizing the tedious and troublesome approach which would arise from multi input fuzzy logic controller design, K. K. Tan et al. [6, 7] proposed an elevator control system using fuzzy logic algorithm based on the ordinal structure theory [9]. In this method, fuzzy rule base is described in one dimensional form [6, 7], which promises simplicity in forming the rule base, in cases where many fuzzy inputs have to be considered. The advance system is using destination based elevator control system that was proposed by Kumeresan A. Danapalasingan and Marzuki Khalid[9]. When destinations are known in advance and no floor buttons can be pressed by passengers traveling inside a cabin, nearly complete and reliable information about a given traffic situation is available, making the dispatching problem much more amenable to combinatorial search techniques [10]. This system has problem when one person press many time keypad. It can make the system confuse and some time it can make the system failure to work.

In this paper was discuss how to decrease the system failure to work and also who to minimize the waiting time when destination based elevator control system be combine with the video camera.

II. VIDEO BASED ELEVATOR CONTROL SYSTEM

The basic concept of the system from destination based elevator control system. A ten digit keypad is installed in front of the elevator group where passengers indicate the floor to which they wish to travel [11]. Upon receiving the destination, the elevator control system selects an elevator to transport the passenger [10]. At the same time, the number of press keypad destination will be count to check the traffic on that floor and allocate the elevator. The system will count the pressed button and when it full request level, some level can not request the elevator. Some time the system failure to work at the peak time or non peak time. This occur when one person has press the keypad button twice times or more and waiting time will increase. To solve this problem, camera has added to all level and monitor the traffic (number of person waiting).The image from camera will be count by the system. The result will be compare with the number of press keypad destination .If the result is not same, the system will be make it equal both input by automatic cancel the first press keypad destination. Figure bellow shows the idea of this project:

Figure 1: Keypad Destination and Camera [9]

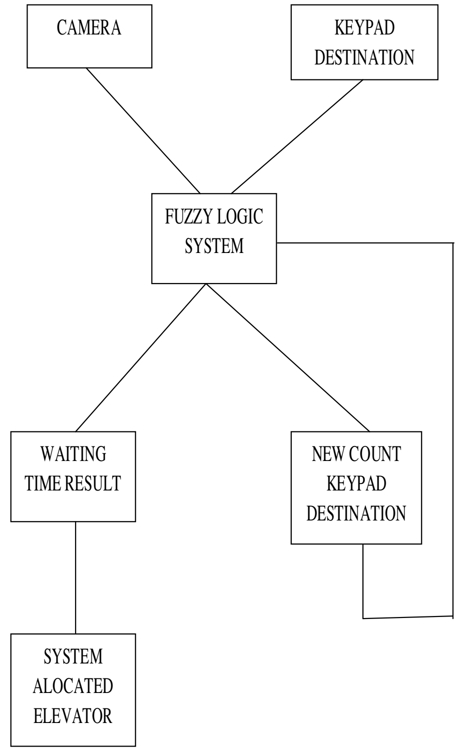


Figure 2: The system flow

III. ELEVATOR CONTROLLER SYSTEM

There are many factors that will effect the waiting time for person wait the elevator. In this paper, only the major factors were discussed. There are 4 major factors:

- Motor speed
  Motor speed has depended on the load in the elevator. To increase motor speed, more power needed to supply to the motor.
- Distant lift
  In constant motor speed, long distant between the floor request can take long time. To decrease the waiting time for this conduction, intelligent system may be use. The system can determine where elevator has short distant between the floor requests.
- Number person waiting
  During the peak hours, there are more person waiting elevator and high request elevator. It can make the waiting time increase

- The system failure
  When the keypad destination has press many times, the symbol “XX” will be appearing. It means that the system has full request elevator.

The factor is used as an input to the fuzzy logic, with some modification to suit the requirement. The proposed fuzzy logic system consists of 3 inputs and 2 outputs, which are:

Input

- Distant elevator(DE)
  The distant between the request level and the elevator
- Number of person(NP)
  Number of person that waiting out side elevator. It will be capture by the camera
- Number of button press keypad destination(NB)
  The amount of person that press the keypad destination

Output

- Waiting time(WT)
  The output of the fuzzy .The system will be calculated the waiting time.
- New count press keypad (NC)
  The output of the fuzzy. That be use to correct the number of press keypad and make it equal to the number of person waiting on the request floor.

The membership functions of the inputs and output, as well as fuzzy inference rules are given in Figure. 3.4 and Table 1 respectively.

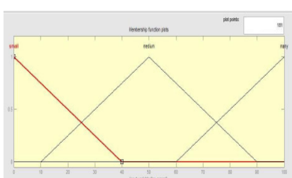


Figure.3: Membership Function of the input

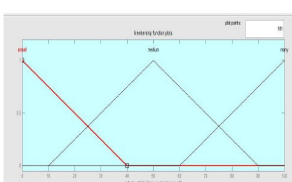


Figure 4: Membership Function of the input

Input			**Output**	
DE	**NP**	**NB**	**WT**	**NC**
S	S	MA	S	S
S	MD	MD	MD	MD
S	MA	S	MD	MA
L	S	MD	MD	S
L	MD	S	MD	MD
L	MA	MA	L	MA

Table 1: Some of the rules are use

S – Small, MD – Medium, MA – Many, L – Long Distant

IV. RESULT AND DISCUSSION

The three input of fuzzy logic , with DE ranging from 0 to 15, NP ranging from 0 to 100 and NB ranging from 0 to 100 is test and the simulation result is shown as in figure 5

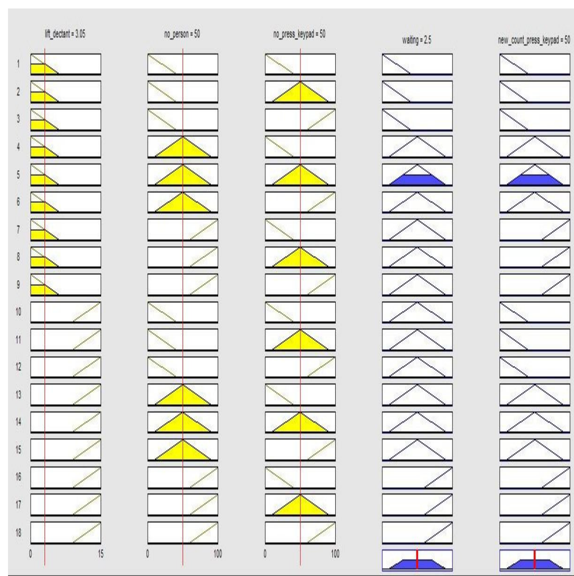


Figure 5: Result when variable DE and other is constants

Figure 5 above shows that when input DE is set to short distant and other two inputs are set to medium, will result in the waiting time and the new count press be at medium ranging. In this condition that no different between the number of press button and number of person so the output on the new count follows the number of press button.

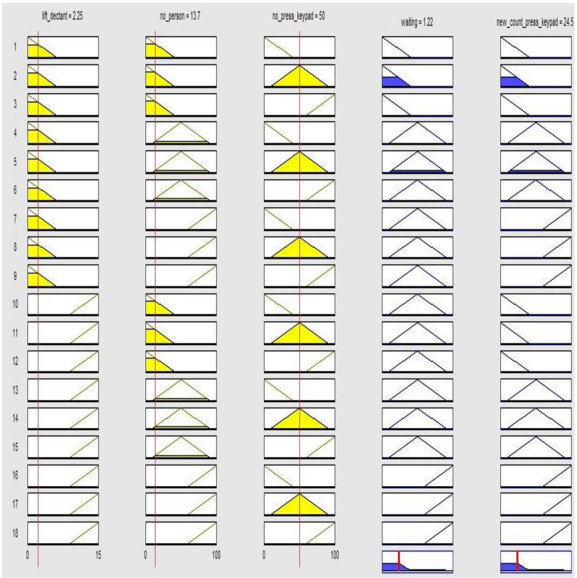
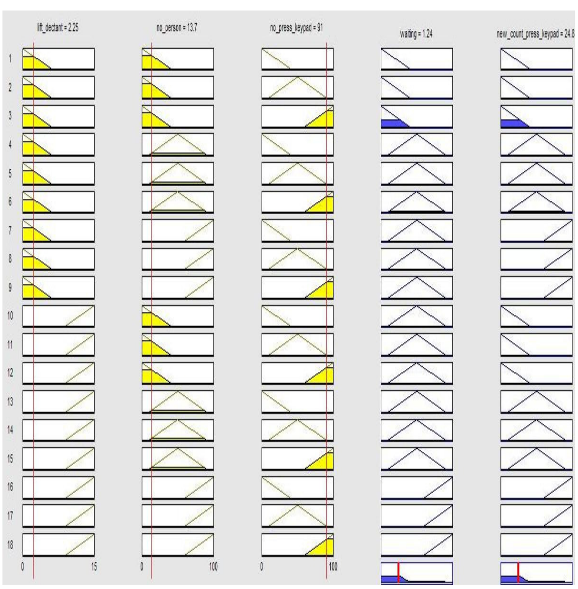


Figure 6: Result two input in low area

If distant in short range and number of person in low range, the waiting time is at low range. This is because of the traffic flow for waiting elevator is low so the time waiting become short. But if there are different between the number of person waiting and the number of press button, the output of new count press will be set according to the number of the person waiting



.Figure 7: Result three input are variable

When the DE is low, NP waiting also low, but the NB press is high then the new count press is set to low. Therefore the waiting time is set to low according to the DE and NP.

V. CONCLUSION

In this project, a simulation of fuzzy logic on toolbox matlab are use to see the result. By using fuzzy inference rules of systems with multiple inputs, could be formed with minimum effort. As conclusion, from the simulation it shows that this idea can be use in order to minimizing the waiting time and solve the problem of the system failure.

VI. FUTURE RECOMMENDATION

For future development suggested that, this system may be test on the real simulator. The simulator must have the complete model with camera that can monitor and integrate the full function for this idea. From the simulator, the accurate result can get from the simulation. The program will be test on the simulation before it can use in real situation

VII. ACKNOWLEDGEMENT

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VII. REFERENCES

[1] G. R. Strakosch, Vertical Transportation: Elevators and Escalators. New York: Wiley, 1983.

[2] C. B. Kim, K. A. Seong and H. Lee-Kwang, "*A Fuzzy Approach to Elevator Group Control System*",IEEE Transactions on Systems, Man And Cybernetics,(June 1995), Vol. 25, No. 6, pp. 985-990.

[3] C. B. Kim, K. A. Seong, H. Lee-Kwang, "*Design and Implementation of a Fuzzy Elevator Group Control System*", IEEE Transactions of Systems, Man and Cybernetics – Part A: Systems and Humans, (May 1998), Vol. 28, No. 3, pp. 288-288.

[4]R. R. Gudwin, F.A.C. Gomide, "*Context Adaptation in Fuzzy Processing*", Proceedings of the Brazil-Japan Joint Symposium on Fuzzy Systems, Campinas, SP, Brazil, (July 1994), pp. 15-20.

[5] A. Fujino, T. Tobita and K. Segawa, "*An Elevator Group Control System with Floor-Attribute Control Method and System Optimization Using Genetic Algorithms*", IEEE Transactions on

Industrial Electronics, (August 1998), Vol. 44, No. 4

[6]K. K. Tan, *"Fuzzy Reasoning by Ordinal Structure Model for Elevator Group Supervisory Control*", Masters Thesis, Universiti Teknologi Malaysia, January 1997.

[7] K. K. Tan, M. Khalid, and R. Yusof, "*Intelligent Elevator Control by Ordinal Structure Fuzzy Logic Algorithm*", Proc. of ICARCV 97, Singapore, (Dec. 1996).

[8]T.Ohnishi, "*Fuzzy Reasoning by Ordinal Structure Model of Control Rule*", Journal of Japan Society for Fuzzy Theory and Systems, (1990), Vol. 2, No. 4, pp 125-132

[9]Danapalasingam, Kumeresan A. and Khalid, Marzuki (2005) *Design of an Elevator Group Supervisory Controller using Ordinal Structure Fuzzy Logic with Context Adaptation.* In: Proceeding of the 9th International Conference on Mechatronics Technology, 5-8 December 2005, Kuala Lumpur.

[10] P. Friedli, "*Group Control for Lifts with Immediate Allocation of Destination Calls*", Schindler European Patent 0356731B1, 1989

[11] J. Koehler and K. Schuster, "*Elevator Control as a Planning Problem*", Proceedings of the 5th International Conference on Artificial Intelligence, Planning and Scheduling, AAAI Press, Menlo Park, (2000), pp. 331- 33