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Factors Affecting Service Workforce in Optimizing Service Performance: An Analysis Based on the AIOT Platform

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1. Abstract

Medical internal transportation service is an important operation of the hospital. Out-sourcing it can mobilize hospital manpower, save costs, and also incorporate professional technology and operation management from private enterprise. However, how to innovate the services, improve performance and service quality as well as reduce hospital costs are crucial issues for the hosting hospital. Here, our study was aimed to: (1) shorten the waiting time of patients for medical internal transportation services (2) improve the efficiency of internal transportation services, shorten the time required for transportation of cases, and reduce the physical wear and shed of transportation personnel; (3) reduce hospital-related costs. We collected information from the dispatch system The variables included the task type, ward dispatch time, service center dispatch time, operation time, completion time and even movement path of the dispatch case. We then constructed an intelligent dispatch system based on Beacon, a real-time positioning system. We used a simulation algorithm to determine optimal rules for comprehensive dispatch, and applied them to the daily medical internal transportation service to optimize manpower for each period. We found that applications of our intelligent dispatch system together with mobile devices for dispatch reduced telephone contacts between transport personnel and service center. In addition, a marked shortening of time duration in transportation of cases, reducing manpower costs, and enhancing the flexibility of manpower usage were also achieved. Furthermore, it can relieve physical wear and shed of personnel, as well as improve the efficiency of operation and service quality. The scope and density of related facilities (such as Beacon) affected the effectiveness of the operation of the intelligent dispatch system. In conclusion, intelligent dispatch system can promote the efficiency of medical internal transportation services.

2. Introduction

Big data is profitable for the hospital service system (Caraka et al, 2022). Through data backtracking, here we collected big data optimize the operation of our dispatch system. Regarding the dispatching process, we collected relevant information such as task type, ward dispatch time, service center dispatch time, operation time, completion time and even movement path for further analysis. We used the information for developing an intelligent dispatch system based on Beacon, an existing real-time positioning system. Simulation-based algorithms were applied to determine comprehensive dispatch rules, which were then used for the daily internal transportation services. Also, the optimal transportation service manpower was established for each time frame. The main purposes of the study are to investigate if intelligent dispatch system can:

(1) Shorten the waiting time of patients for medical services and reduce the waiting time for customers or patients within the internal transportation services.

(2) Improve the efficiency of internal transportation services, shorten the time required to transportation of cases, and reduce the physical wear and shed of transportation personnel.

(3) Reduce hospital-related costs: The work content of the hospital internal transportation personnel is to transfer patients to outpatient clinics, wards, examination centers and other units. The mode of transportation includes leading, pushing beds and wheelchairs, as well as handling medications, blood samples, specimens, articles, instruments and stationery to other units (Shi Yuzhe, 2015) [2, 7]. These tasks belong to the hospital logistics support unit, under the control of cost and quality. These transportation works are performed by a group of trained non-medical personnel. Although it is also the first line to provide patient services, the work content is non-medical behavior. These works are guided by management strategies to help hospitals developing core services, improve operational efficiency, reduce operating costs and risks, enhance the operational flexibility of enterprises, innovate capabilities and create opportunities for added value for customers (Lin Jingyi, 2009) [4-6]. These transportation services are outsourced to private professional service companies, in close relationship with hospital operations. In such close relationships, it is crucial to innovate services, improve both performance and quality of service, as well as reduce hospital costs. To minimize delays caused by paper or telephone use at the service center in dispatching work, the hospital requires the contractor to build an intelligent dispatch system to connect with the hospital's existing transportation service system. The service center, when receiving a transportation order from a ward or medical unit, can automatically or manually assign the task, typically by the dispatch team leader. The transportation personnel will discover and accept the task through their handheld mobile devices. Such a mobile device also displays the related information (e.g., hospital bed, name, demand time, and transmission location). After task execution, confirmation messages will return to the original unit and management personnel (i.e., the leader of the service center dispatch team) for electronic signature. Beginning in 2019, the cooperated hospital has fully established a real-time positioning system (called 'Beacon') covering movement areas of the service personnel. It is expected to use the real-time positioning system to build a smart dispatch system. The staff can dispatch workers to the nearest location immediately to improve the efficiency of transportation service for health care purposes. This system has reduced round-trip manpower and simplified the whole process.

3. Materials and Methods

In medical service, the waiting time and human resources for both patient and medical staff are very important factors affecting not only the cost but also the quality of services. Big data analysis can improve the hospital service system. One classical problem is the non-optimal deployment of staff will incur unnecessary costs (Rezzy Eko araka, 2022) [14]. Big Data analysis can help solving these problems. In the literature, process improvements or resource allocation can reduce waiting times for patient care, improve operational efficiency. They can also access and reduce the cost of transporting patients to hospitals (Olli-Pekka & Ville 2016) [1,3]. Hospitals often face uneven resource allocation and complicated operation processes, resulting in excessive waiting time for patients. Sung & Arun (2010) [15,16] used simulation methods to improve the emergency care process of hospitals to improve resource utilization and reduce patient waiting time. Lian Gengfeng (2012) [8] used the simulation software ARENA_13.0 to model to reduce consultation waiting time of patients. Zhang Maintenance (2014) [9] improved operating room planning through system simulation. In this study, we collected big data from completed orders of the existing dispatch system through backtracking. The data we collected included the task type, ward dispatch time, service center dispatch time, operation time, completion time and even the movement path. We planned to construct an intelligent dispatch system based on an existing real-time positioning system (i.e., Bea- con), and to apply simulation algorithms to determine better comprehensive dispatch rules for daily transportation of worker dispatch. The system built the optimal mode of transportation service manpower in each time frame (Figure 1).

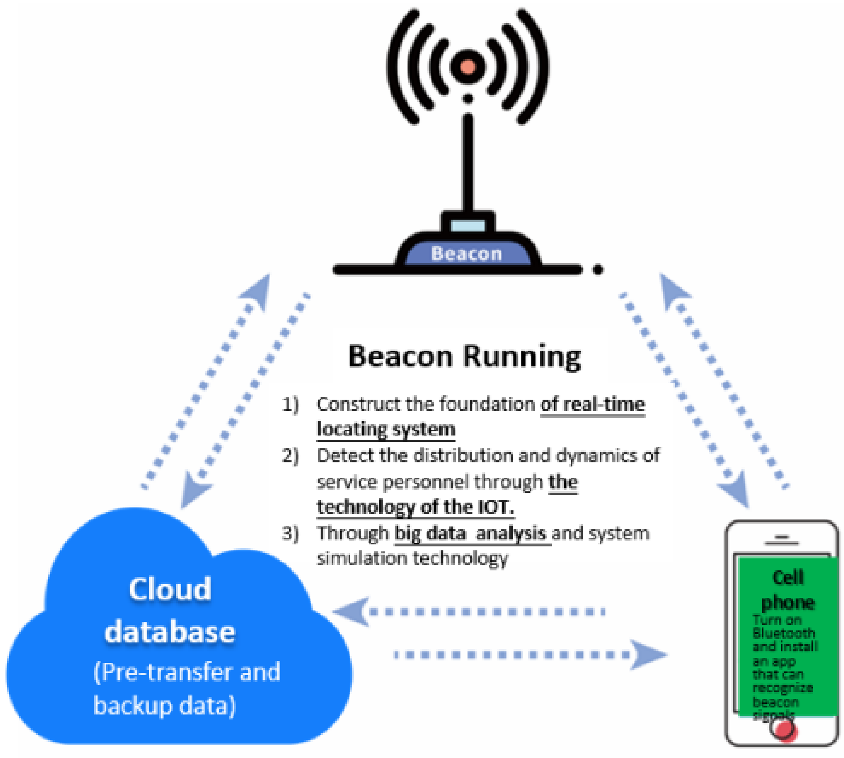

Figure 1: The transportation system model.

3.1. Basic Theories and Assumptions

Three different dispatch methods were selected: first in first out (FIFO), shortest process time (SPT), and early due date (EDD) as candidates for developing our intelligent dispatch system with real-time positioning support.

A. First in first out (FIFO): This is the rule used to prioritize the earliest arrival at the target site according to the time of individual arrivals at the target location.

B. Shortest process time (SPT): This is the rule on the working time of each task, and it prioritizes those with the shortest dispatch time.

C. Earliest due date (EDD): This rule is based on the due date of each dispatched task and prioritizes those with the shortest delivery time.

3.2. Application Data Range

Data transmissions were all completed in 2020. The data included task content, operation time, classification, and so on. Data screening and integration included transportation service sent by the service center to each floor, the dispatch time generated by notifying the transportation personnel to perform the task, and the time when the transportation personnel arrive at the location of the transportation service, and the time required for recording the transportation, waiting time and other information.

3.3. The Process of Experimental Data Collection

Input data collection and analysis data collection served two purposes: (a) to obtain data on actual resource allocation and operation process; (b) to obtain data for simulation analysis. Such data included, the transportation service time, the transportation team statistics, the blood draw time, the number of nursing personnel, and the number of people in the daily human transportation room to grasp the actual resource allocation, and to measure and record the start time of service at each unit.

3.4. Methods for Data Analyses

Identifying and collecting the data that needs to be entered by the model is no simple task. We collected data and distinguished their logical significance in the systematic steps performed. Because no single person nor file has complete information, a full analysis is required. The data collected must be used for specific parameters and input into probability allocations. In general, the source of a random variable can be expressed with a suitable probability allocation.

4. System Design and Construction

4.1. Data Collection and Analyses, And Construction of the Beacon Intelligent Dispatch Model

4.1.1. Statistical Analyses of Historical Case Data

A. The labor service delivery of the cooperated hospital is outsourced. The labor service staff is divided into two categories: «distributed dispatch» and «centralized dispatch». The «distributed dispatch» staff are stationed in the ward or related medical departments to perform routine local service. The total number of employees is 201. The «centralized dispatch» staff are the transportation personnel, with three shifts, concentrated at three service centers. The staff, a total of 133 people, are assigned by the dispatch team leader to perform mobile transmission cases. Statistical analyses revealed the average number of cases delivered by the Court is about 33,463/month (daily average: 1,115), and these cases are handled by 133 transportation personnel.

B. When the system receives a dispatch order, the service center dispatch team leader assigns a transportation personnel for this operation. The transportation personnel must arrive at the departure place (e.g., ward, operation room) within 15, 30, 60 min, and so on to report to the nursing staff and start the task. The other scheduled case is to deliver the patient at the specified time (>60 min from the dispatch time). But often due to insufficient manpower, improper scheduling, factors like waiting for an elevator or an inspection, the moving times are too long leading to unexpected delays. Taking those cases from November 2020 to December 2020 as an example, details of such delays are shown in (Figure 2) (average delay rate is 32.14%). In the event of receiving oxygen cylinders, pushing patients to take X-rays, different working styles or incidental factors that occur during different time periods of the day, the statistical delay rates vary, as shown in (Figure 3) (average delay rate is 24.82%).

Figure 2: Transportation case delay rate.
Source: Statistical analysis of this study.

Figure 3: Transportation case delay rate（Exclude X-ray and receive O2).
Source: Statistical analysis of this study.

4.1.2. Planning and construction of the Beacon Intelligent Dispatch Model

A. We used the 350 real-time positioning system (Beacon) that has been fully established since 2019. The hospital has built an intelligent dispatch system such that its staff can be dispatched to the nearest location in real time. The system improves the efficiency of transmission service, supports medical services, and reduces the process and round-trip manpower.

B. Until now, 350 Beacons have been established in the hospital (the locations are set up as shown in Appendix 1) for data transmission across 523 locations. Some locations shared the same Beacon. Details are as follows:

131 locations: 1 Beacon for 1 location

116 locations: 2 locations sharing 1 Beacon

33 locations: 3 locations sharing 1 Beacon

20 locations: 4 locations sharing 1 Beacon

15 locations: 5 locations sharing 1 Beacon

12 locations: 6 locations sharing 1 Beacon

14 locations: 7 locations sharing 1 Beacon

9 locations: 9 locations sharing 1 Beacon

The Beacon set up list is shown in (Table 1).

C. We used the above Beacons for transmission locations, and applied the existing dispatch system to correct and build the dispatch system APP. The initial «limited urgent parts» refers to the construction and testing scope. When the unit (such as nursing station) dispatches an emergency case, the intelligent system detects the Beacon device with UUID such as «fda50693-a4e2-4fb1-afcf-c6eb07647825» to determine the location of the transmitting personnel for 1.1 sec. When the system finds the device, it adds conditional judgment (such as whether the transportation personnel is currently performing a task) to decide whether or not to assign a task to the transportation personnel. The diagram of the system and the dispatch processes are shown in (Figures 4 and 5). The screens of the intelligent dispatch system of the service center and the transmission of the personnel mobile device APP are shown in (Figures 6 and 7).

Table 1: Beacon setting location statistics table.
Source: Information center of the Hospital.

Floor	Quantity	Floor	Quantity
First Medical Building B2F	6	Second Medical Building B2F	3
First Medical Building B1F	6	Second Medical Building B1F	9
First Medical Building 1F	22	Second Medical Building 1F	17
First Medical Building 2F	13	Second Medical Building 2F	16
First Medical Building 3F	5	Second Medical Building 3F	4
First Medical Building 4F	2	Second Medical Building 4F	1
First Medical Building 5F	3	Second Medical Building 5F	8
First Medical Building 6F	5	Second Medical Building 6F	1
First Medical Building 7F	3	Second Medical Building 7F	3
First Medical Building 8F	5	Second Medical Building 8F	1
First Medical Building 9F	2	Second Medical Building 9F	1
First Medical Building 10F	2	Second Medical Building 10F	1
		Second Medical Building 11F	2
Outpatient building front building 1F	26		
Outpatient building front building 2F	10	Outpatient back building 1F	10
Outpatient building front building 3F	31	Outpatient back building 2F	2
Outpatient building front building 4F	15	Outpatient back building 4F	1
Outpatient building front building 5F	40		
Outpatient building front building 6F	28	Emergency Building B1F	2
Outpatient building front building 7F	27		
Outpatient building front building 8F	14		
Total	265	Total	85

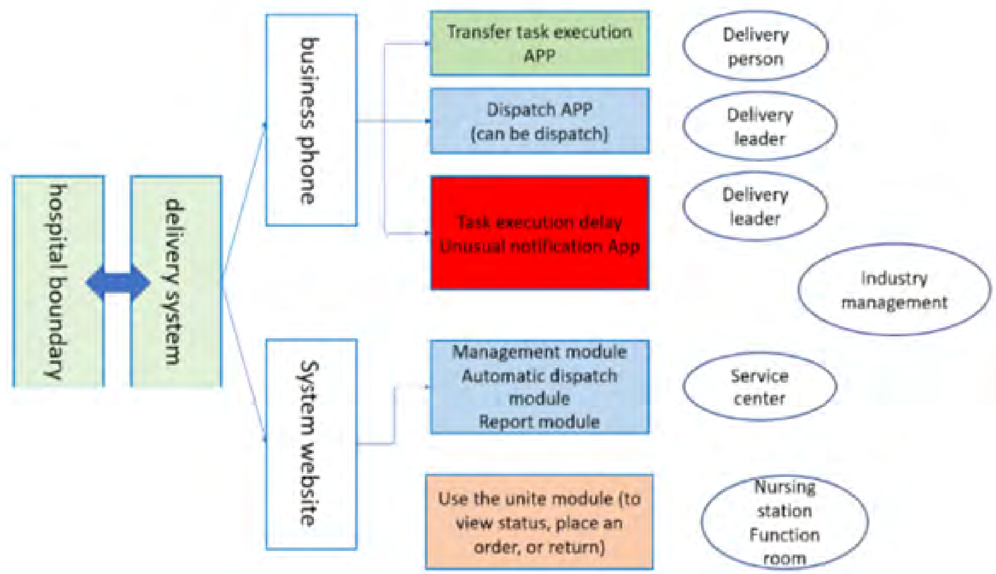

Figure 4: Conveyor system architecture.
Source: e-PORTER conveyor management system.

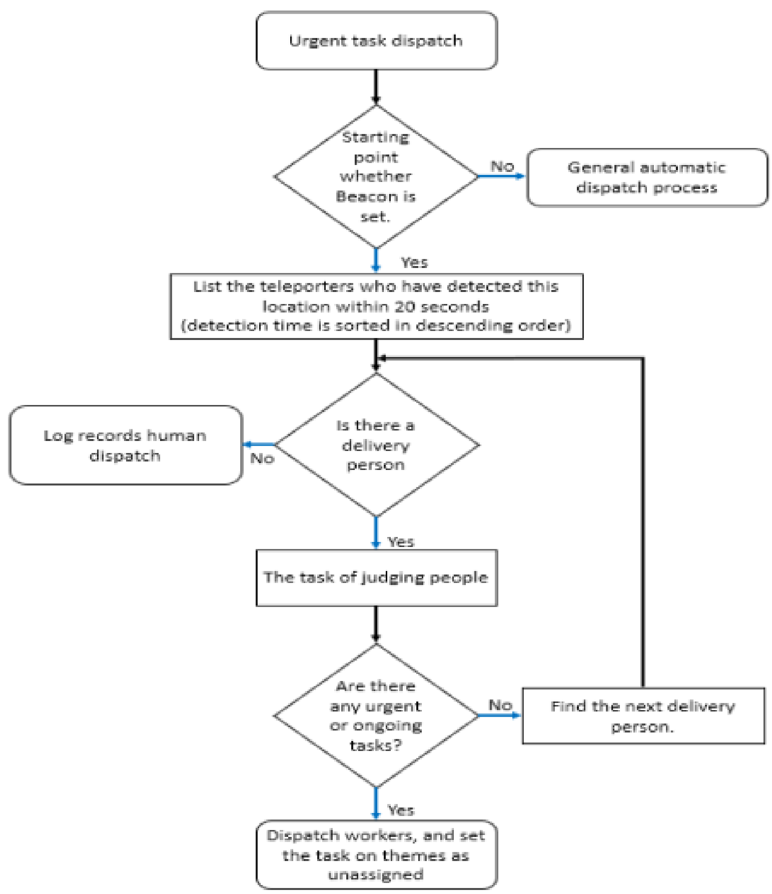

Figure 5: Beacon intelligent dispatch process.
Source: e-PORTER transmission management system.

Figure 6: Intelligent dispatch dynamic dashboard.

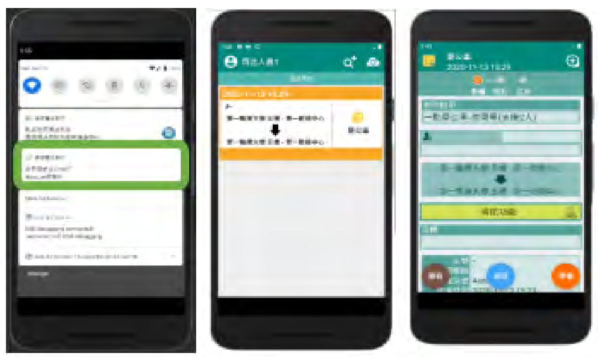

Figure 7: Mobile device dispatch information display.
Source: e-PORTER transmission management system.

4.1.3. Beacon Intelligent Dispatch Test

A. Test Time:

I. January 12, 2021 10:00 AM - 15:30 PM

II. January 19, 2021 10:00 AM - 15:30 PM

III. January 29, 2021 10:00 AM - 12:00 PM

B. After the system is established; the necessary personnel system operation training is carried out to avoid disturbance to the existing transportation services. After the actual on-line test and adjustment, the general dispatch, beacon intelligent dispatch and related data statistical analyses are done as detailed in (Table 2).

C. 2021/01/12 (10:00 AM -15:30 PM) - we compared the Beacon intelligent dispatch system with the general dispatch method. The average dispatch time was shortened by 43.60%. The arrival time of the delivery personnel to the start location was shortened by 18.03%. The delay rate was reduced by 2.9%.

D. 2021/01/19 Adjusting the system and retesting after personnel training (10:00 AM-15:30PM): we compared the Beacon intelligent dispatch method with the general dispatch method, and found the average dispatch time was shortened by 53.86%. The arrival time of the conveyor personnel at the starting point was shortened by 40.43%. The delay rate was reduced by 15.34%.

E. 2021/01/29 (10:00 AM - 15:30 PM) - we compared the Beacon intelligent dispatch method with the general dispatch method, and found that the average dispatch time was shortened by 75.74%. The arrival time of the conveyor personnel to the start place was shortened by 61.94%. The delay rate was reduced by 26.7 %.

F. After dropping the first-time deviations due to human training and operation errors, the average dispatch time of the remaining two tests was shortened by 59.67%. The average time of the delivery personnel arriving at the starting place was shortened by 39.99%. The average delay rate was reduced by 14.8%. Therefore, results showed that with expanded implementation time and scope of tests, the new system will greatly save manpower, reduce the physical loss caused by the movement of the conveyor personnel, and reduce the waiting time of patients.

Table 2: Beacon automatic dispatch test performance statistics table.
Source: This study is self-contained.

		110/1/12	110/1/19	110/1/29
General Dispatch	Total Number of Express Items	765	528	733
	Number of Delays	225	129	196
	Delay Rate	29.41%	24.43%	26.70%
	Average Working Time	06:07	5:23	05:05
	Average Time To Arrive At Starting Point	13:35	11:35	12:00
Beacon Dispatches Workers	The Total Number Of Express Sent By Beacon	34	22	13
	Number of Delays	9	2	0
	Delay Rate	26.47%	9.09%	0%
	Average Working Time	3:27	2:29	1:14
	Average Time To Arrive At Starting Point	11:08	06:54	04:34
The Portions of Workers Dispatched bt Beacon	Period	10: 00-15:30	10: 00-15:30	10: 00-12:30
	The Number of Urgent Pieces within in the time period	311	287	86
	The Number of Beacon Dispatched During the Period	34	22	12
	The Portion of Beacon Dispatched Workers	11%	7.60%	14%

4.1.4. Delivery of «Limited Shipments» Using Beacon Intelligent Dispatch

[1]. Trial period: March 9, 2010 to October 31, 2010 (5/27 to 8/9 during the severe COVID-19 epidemic period, implementation of the test in the sub-compartment diversion was suspended).

[2]. In the case of «limited urgency», when the service center receives the dispatch of a responsible person so assigned, the start point must be reached within 15 min. Most of these cases are pushing patients for surgery, emergency examination or emergency medical services. Here, the average delay rate of the general dispatch service is 30.3%. After testing, the system dispatch logistic adjustment and the educational training of all attendants are carried out. The «special urgent» Beacon intelligent dispatch is a pilot test system at this stage.

[3]. Statistical analyses of the transportation service execution records during the collection and test results are as follows:

A. The average dispatch time of «General Dispatch» is 5 min 23 sec. The average dispatch time of Beacon Intelligent Dispatch is 1 min and 13 sec. Between the two is a difference 4 min and 10sec (75.85%) (inter-curve disparity as shown in (Figure 8).

B. The average dispatch time of «General Dispatch» arriving at the start location is 12 min and 44 sec. The average dispatch time of Beacon intelligent dispatch is 7 min and 17sec, which is faster by 5 min and 27sec (42.8%) (Figure 9).

C. The average delay rate of «General Dispatch» is 30.3%, and the average delay rate of Beacon intelligent dispatch is 11.67%, with a difference of 18.63% (or a reduction by 61.49%) (Figure 10).

[4]. During this stage of trial, except for the special cases intelligently assigned by Beacon, other levels (general cases, urgent cases and scheduling cases) are still dispatched manually by the team leader of the service center. Limited by manpower, when the Beacon intelligent dispatch is completed, the service center dispatch team leader executes other cases. The completed Beacon smart dispatch cases (hereinafter referred to as the transfer) are often canceled manually. Issues seen during the trial period are summarized below:

A. In general, the manual dispatch team leader considers the task type and location of the attendant, commonly in the event of multiple cases, and multiple dispatchers to save manpower. Whereas the Beacon smart dispatcher can only assign one service case at a time (wasting manpower). For these reasons, the dispatch team leader often considers the case volume and adopts manual dispatch instead of the «assigned Beacon dispatch case».

B. When the teleporter completes a previous case, the dispatch team leader would like to assign the teleporter a scheduled case. However, the tele porter is searched by the intelligent dispatch system and is assigned a task. The result is an interference between artificial and intelligent dispatch systems.

C. Beacon intelligent dispatch, when assigning delivery personnel to perform continuous inspection tasks (package service, such as electrocardiogram, X-ray and anesthesia visits and other services), currently follows the principle of first task dispatch. But when the second and third tasks are being performed, the free transportation personnel will be assigned tasks by the intelligent dispatch system. The result is a dilemma.

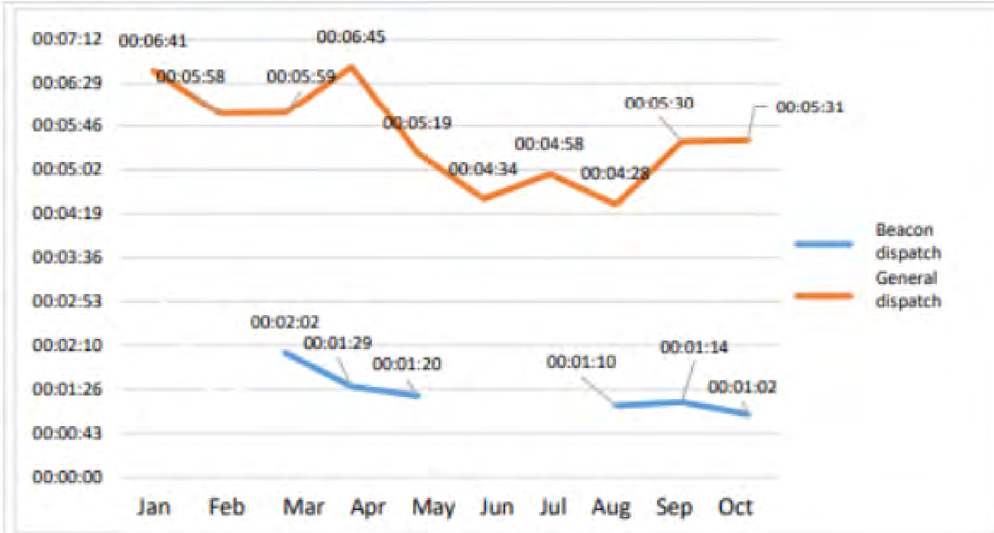

Figure 8: Comparison graph of the average dispatch time of the LIMITED Shipment Beacon dispatch test. Source: Statistical analysis of this study.

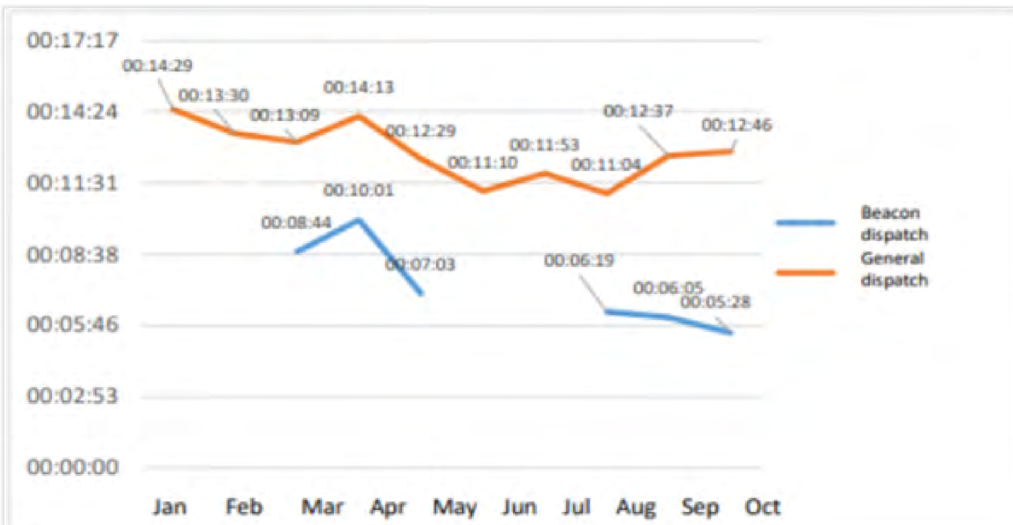

Figure 9: Comparison graph of the average time of arrival at the start site of the LIMITED Shipment. Beacon dispatch test Source: Statistical analysis of this study.

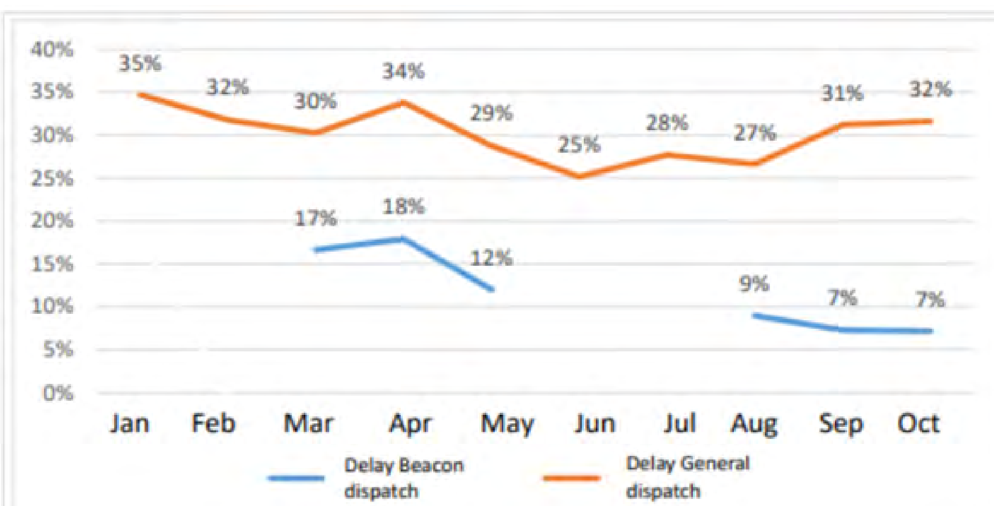

Figure 10: Comparison graph of the average latency rate of the LIMITED Shipment Beacon dispatch test. Source: Statistical analysis of this study.

4.1.5. Transmit The «Full-Level Case» Beacon Intelligent Dispatch

[1]. Trial period: November 22, 2021 to December 8, 2021, 18:00 PM to 22:00 PM every day.

[2]. After the system is built, the necessary personnel system operation training is carried out. The task is automatically dispatched by the system independent of the service center. The relevant conditions for all case level ranges (emergency, non-urgent, schedule) are as follows:

A. The team leader assigns three people outside the Beacon system from automatic dispatch.

B. System dispatch priority: Every 10sec, the system sets an interval for the pre-arrival time tasks that are about to expire in the next 3 min. The tasks in this interval are then sorted according to the urgency level. The order is prioritized as described above.

C. The automatic dispatch time is set 15 min before the pre-arrival time of express, urgent and non-urgent orders. The 45 (30+15) min before the scheduled time of the scheduled task is the automatic dispatch time.

D. The system finds the way to transmit personnel: first check whether there are available transportation personnel meeting the dispatch requirement on the same floor of the task order. If not, extend to upper and lower floors to check similarly available transportation personnel on the floor closer to the task order have higher priority. If no idle transportation personnel are available in the same building, those of the adjacent building will be dispatched.

E. In the First Medical Building (2 people), Second Medical Building (2 people), and the Emergency Building (1 person), a special account is established for the daily physical examination, medical and other specific transmission personnel to perform, all outside the Beacon automatic dispatch.

[3]. After system adjustment and actual line trial, the general dispatch, Beacon intelligent dispatch and related data statistical analyses are detailed in (Table 3).

A. According to the test statistics of the «full-level case» Beacon intelligent dispatch, the total number of dispatched vehicles is 259. The Beacon intelligent dispatch is 88, that of artificially transferred is 31. Beacon intelligent dispatch wins in 57 (the rate is 22%).

B. Compared with the general dispatch, the time saved in Beacon intelligent dispatch system is 9 min and 19sec (50.18%). The arrival time of the teleporter to the start location is 6 min and 37sec (29% reduction). The delay rate is lowered by 7.55%.

Table 3: Statistical table of full-level Beacon intelligent dispatch results. (This information is calculated on a daily average basis).

General dispatch 18:00-22:00	Average total number of dispatches	202
	Average latency	73
	Average latency rate	35.73%
	Average dispatch time	0:19:04
	Average time to arrival at the starting point	0:22:49
Beacon dispatches workers 18:00-22:00	Total Beacon Shipments (Average)	57
	Average latency	16
	Average latency rate	28.18%
	Average dispatch time	0:09:45
	Average time to arrival at the starting point	0:16:12
Beacon dispatch volume ratio	Time	18-22
	Total number of pieces in the time period (average)	259
	The average number of jobs dispatched by Beacon during the period	57
	Beacon Dispatch Ratio (Average)	22.00%
Transfer rate (Beacon was artificially cancelled or transferred after dispatching workers).	The average total number of pieces during the time period	259
	The total number of workers dispatched by the original Beacon	88
	Finally Beacon dispatched an average total number of workers	57
	Number of transfers (average)	31
	Transfer rate (average)	34.45%
Case delay rate after being transferred		70.26%

5. Research Findings and Effects

5.1. Improving Efficiency of Transportation Operations and Reducing Delay Incidence

It is through the mobile device held by the conveyor and the automatic search by the Beacon real-time positioning system that determines the location of a teleporter. When the successful search is coupled with conditional judgment (such as whether the teleporter is currently performing a task), the dispatch system automatically dispatches tasks. The law of automatic dispatch is placing the task start location at the center of a circle. The search for a closer distance and in line with the dispatch rules of the eleporter is the object. Compared with the manual dispatch, the proposed scheme reduced the «dispatch time» by 50.18%, greatly reducing the internal and external customer waiting times. Furthermore, it speeds up reaction and shortens preparation time of transmission personnel, hence reducing the delay rate and indirectly minimizing unsafe incidents.

5.2. Reducing The Dispatch Error Incidence and Improving Reliability of Transportation Operations

In general, the manual dispatch department is composed of a dispatch team leader, who manually screen through cases in the dispatch system. The leader needs to move a computer mouse pointing to the desired transportation personnel to execute the task. During peak hours, workload to the dispatch team leader increases, often resulting in missing or wrong dispatches. The Beacon dispatch system reduces error incidence and unloads work of the team leader.

5.3. Saving Manpower, Reducing Costs, And Increasing the Flexibility of Managing Transmission Manpower

Beacon intelligent dispatch helps to save manpower. According to the statistics, the «full-level case» Beacon intelligent dispatch effect, the Beacon intelligent dispatch rate is 22%. The arrival time of the conveyor personnel at the starting place is 6 min and 37 sec. The average daily transportation case of the hospital is 1,115, that means a savings of 27.1 hours' man-hours per day, and that means saving 3.4 daily working hours of a conveyor personnel. In addition to reducing costs and increasing the flexibility of transmission manpower, the effect is more significant given a gradual increase of the Beacon intelligent dispatch ratio.

Time savings: (1.115 pieces × 22% × 397 sec) 3,600 sec= 27.1 hour

Manpower savings: 27.1 hours ÷ 8 hours/day = 3.4 people/day

5.4. Reducing The Time Required to Transfer Cases and Physical Wear and Shed of the Conveyor

A. In general, when the dispatcher completes a service, he/she must return to the service center or be contacted by phone for the next assignment. The Beacon smart dispatch rule is to search outwards for the teleporter closest to the location where the task will begin. Therefore, when the teleporter is successfully searched, they can go directly to the starting point to perform the mission. The strategy can eliminate the round-trip journey back and forth to the service center to reduce the walking distance and other damages caused by physical exhaustion.

B. Based on the average adult walking speed of 1.32 (meters/sec) (PengYuhan, 2009) [10-13], Beacon intelligent dispatch is 6 min and 37% less than the general dispatch time per transportation case. The approximate measure can reduce the physical exhaustion of the teleporter walking for 524 meters (without considering factors such as waiting for the elevator and the number of crowds).

6. Discussion

[1]. In this study, the «model construction» was used to simulate the intelligent model of transportation service using the hospital Beacon real-time position-ing device. Through data collection, model verification and confirmation, it presumably simulated the optimal system. The verification process has been gradually expanded from a small area, where the transportation service must continue to operate. The test was carried out with «general manual dispatch» and «Beacon intelligent dispatch» operating in parallel. Some problems that compete or interfere with each other remain to be solved.

[2]. The use of AIOT to build an intelligent mode of transportation service sys-tem can reduce manpower costs and improve operational efficiency. The higher the intelligent ratio, the greater the benefits. However, in the compli-cated transportation service project, the Beacon wisdom dispatch or manual dispatch of workers will be applied to the project. A clear distinction must be made between the two systems, with one being main and another auxiliary when implemented simultaneously. In the first place, it is possible to avoid mutual interference and competition between manual and intelligent systems to build an optimized dispatch model.

[3]. The intelligent system developed in this study is based on the Beacon real-time positioning device. The density and scope of Beacon construction willaffect the effectiveness of intelligent dispatch. In addition, the acceptanceand proficiency of the transportation personnel for the auxiliary transmis-sion service of the mobile device are key to the success of the intelligent dis-patch.

7. Conclusions

The use of «information and communication technology» (ICT) in the medical industry is now a trend of «smart healthcare». The introduction of artificial intelligence (AI) and the service of hospital IOT platforms can not only optimize the patient experience but also greatly improve the efficiency of medical services. This study introduced an intelligent dispatch system and the use of mobile devices to dispatch workers, to improve their work process and telephone contact with the service center, greatly shorten-ing the time of case transportation. The intelligent system reduced manpower costs, enhanced the flexibility of manpower use, and alleviated the physical wear and shed of the delivery personnel, in addition to improving the operational efficiency and service quality. With the rapid changes in the medical environment, the rise of consumer awareness and competition in the same industry, the derivative public attaches greater emphasis on the quality of hospital services. The application of information management and mobile net-work communication technology to the transportation services can greatly improve the efficiency of medical operations and service quality, achieving the purpose of effective management and implementation of the government's promotion of smart hospitals. Subsequently, on the basis of the intelligent transportation service system constructed by AIOT, the decision-making system model for the introduction of hospital transportation service staff will be discussed. The optimal decision-making system between the trans-portation service workload and the transportation service can be discussed in a more accurate and efficient manner. Finally, we hope that it can enable human resources to be allocated and used more efficiently to improve efficiency in supporting medical services.

8. Author Contributions

Writing-review and editing, S.Y.C and S.W.H.; Supervision, S.W.H; Writing-Original Draft, S.Y.C; Visualization, S.Y.C; Conceptualization and Investigation, S.W.H. All authors have read and agreed to the published version of the manuscript.

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10. Data Availability Statement

The data presented in this study are available in article.

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12. Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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