Utilizing AI to improve speed of services in Quick Service Restaurants

Americans were introduced to “fast food” with the opening of the first Quick Service Restaurant (QSR), the Automat, in New York City, on July 7,1912. Soon after, in 1919, came A&W Root Beer and then White Castle, in 1921. The first McDonald’s opened in 1948[*1]. Since then, huge numbers of QSRs have opened, outpacing the growth of sit-down chains because of their convenience and ability to innovate[*1A]. Now, they compete, seeking to differentiate themselves on three main fronts: wait times, staff attitude, and food quality.

Research shows wait time is the most important source of customer satisfaction. To analyze wait time, we broke the service process into two parts:

1. Line up
2. Order and payment

Restaurant operators who optimize these procedures will improve their speed of services and thus, their customer satisfaction. In 2019 the American Customer Satisfaction Index surveyed 23,468 consumers and found that 82% surveyed favored speed of services[*2A].

Impact of Wait Time:

Wait times impact perception and therefore sales. According to J. Lahap et al., negative customer perception increases with the duration of the wait time, which, in turn, negatively affects their view on the quality of the food. Lengthy wait times, thus, negatively impact customer satisfaction and the likelihood they will return[*3]. The primary benefits of reducing wait time include customer retention, sales growth, overall speed to service and improved productivity.

Customer satisfaction:

Satisfied customers are frequently repeat customers[*4]. Studies show lower wait times increases satisfaction, leading to repeat business.

Other factors mitigate how waits time affects customer satisfaction: clients, who know why they are waiting or see progress is being made on their order and have a sense of how long their wait will be, react less negatively than clients who feel left in the dark.

In the article, “The Impact of Product and Service Quality on Brand Loyalty: Evidence from Quick Service Restaurants”, M. Khan et al., outline 4 conditions to Brand Loyalty:

1. **Quality of food:** fresh ingredients, menu variety, new options, food presentation and consistency of quality.
2. **Quality of service:** courtesy of employees, wait-time before being seated, waiting-time before food arrives, appearance of employees, appearance of cleanliness of equipment and wait-time before bill payment.
3. **Cost/value:** the perception of the food being priced competitively.
4. **Place:** appearance and atmosphere of a restaurant, its bathroom, parking, and telephone services.

Increase productivities:

This year, across the United States wages increased by $10.6 million USD. In the last three years, in Seattle, wage costs jumped 70%, from $9.47 to $16 USD per hour[*5]. In addition, restaurants have the highest turnover rate of 73%[*6] With wages continuing to increase, high turnover rates, and low profit margins, the QSR industry needs to stay data-focused if it wants to improve profitability. Business intelligent data such as service time and real-time up-sales are great indicators for managers. The data provide managers the ability to understand their staff performance. Managers can determine if staff members need further training or not by the service times. In addition, the Manager can see which individuals excel at sales promoting the company’s special product of the day or week. Staff members that meet these conditions improve service times and sales and when they receive recognition from the Manager they will feel a greater sense of belonging to the organization. According to D. Smith[*6], three main factors contribute to employee retention: feeling understood and listened to, feeling recognized, and the opportunity for promotion.

Research Methodology for gathering data:

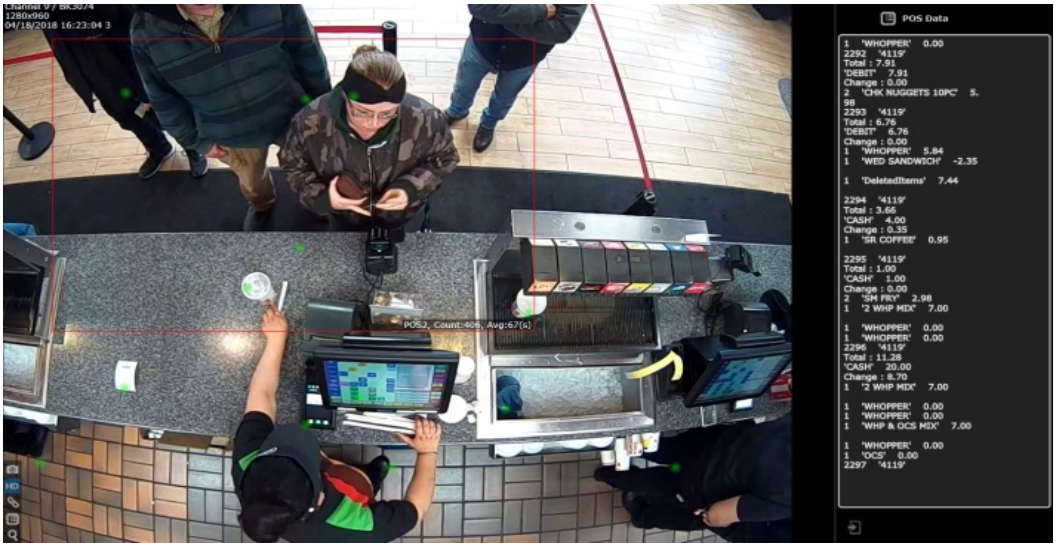
This case study will look at 5 QSRs and the business intelligent data they provided over a 28-day period before and after the implantation of the program. The data was gathered and generated by Closed Circuit Television, using Artificial Intelligence (AI) and Point of Sales integration.

1. Transactions without a customer or a customer at the counter without a transaction
2. Number of customers at cashiers.
3. Wait time of customers at cashiers.
4. Number of customers waiting in the queue.

Camera position and AI calculations:

Mounting camera, choosing specific lens and camera frame rate are requirements for receiving accurate data. The below image is taken from actual video with POS integration. The camera is a 1.3 megapixels (Ax47R2) with a 2.4 mm lens and set at 3-4 frames per second. The red box is drawn, identifying the customer waiting for service and in front of the cashier. The video data is combined with data from POS to generate business intelligent data. 'AI' can recognize people in the defined area (red box area) and alert if there is no customer but a transaction occurs, or there is a customer without a transaction. 'AI' will also calculate the wait time and the number of people in the defined area. Transactions occurring without a customer or customers with transactions are flagged as risks. These two risks raise two critical questions:

1. Why does the cashier operate the POS or open the cash register when there is no customer in front?
2. Why is there a customer without any transaction?

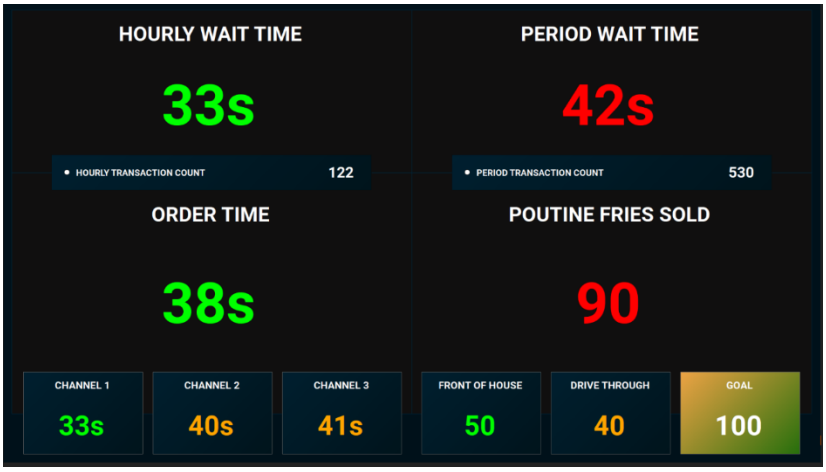


The pictures below are taken from a fisheye, or 360-degree, camera; an option that reduces cost by replacing the functionality of 3-4 cameras with one device. Using ‘AI’, the camera can identify the heads of customers; the numbers in the photos indicate the ‘AI’ identifying a person in the defined area as a customer. In figure 1, the restaurant area is defined into three main areas: in front of POS 1, POS 2, and general waiting time. Every time a customer enters the defined area, ‘AI’ recognizes a person, data is generated and collected, such as, the number of customers entering POS 1 or POS 2 and the wait time.

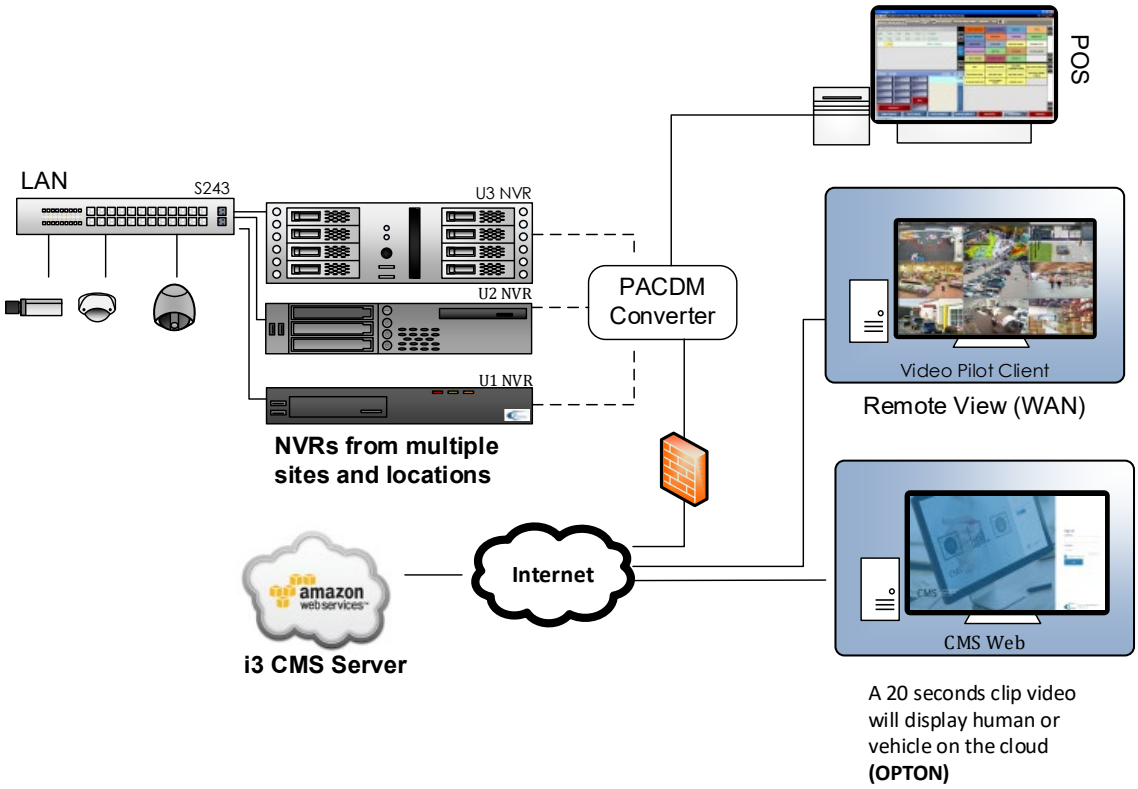
Figure 1.

Pictured below is a Public View Monitor. It provides the QSR manager with data gathered from the POS and 'AI', such as sales numbers for individual items and wait times. The PVM is a valuable tool for reducing wait times and increasing sales. The manager and staff can use this data to figure out ways to cut down on wait times. Access to this data allows management to incentivize improved service by staff via rewards and promotion. Color coding is used to reflect on performance with green exceeding goals and red not matching a goal or target.

The stores introduced the metric to the employees and set goals as noted in the example picture below. With minimal awareness the numbers improved. It is expected that additional awareness and training will improve results even further.



Network Infrastructure:



Result from QSR 1-5:

QSR 1	# of customers			Wait time in seconds		
	POS 3	POS 2	POS 1	POS 3	POS 2	POS 1
1st 28 days average	1159	641	902	42	44	51
2nd 28 days average	1284	640	896	41	42	53
Differences	125	-1	-6	-1	-2	2

QSR 2	# of customers			Wait time in seconds		
	POS 3	POS 2	POS 1	POS 3	POS 2	POS 1
1st 28 days average	243	534	834	49	37	51
2nd 28 days average	232	558	828	48	38	51
Differences	-11	24	-6	-1	1	0

QSR 3	# of customers			Wait time in seconds		
	POS 3	POS 2	POS 1	POS 3	POS 2	POS 1
1st 28 days average	333	894	322	33	39	29
2nd 28 days average	441	916	374	31	35	30
Differences	108	22	52	-2	-4	1

QSR 4	# of customers			Wait time in seconds		
	POS 3	POS 2	POS 1	POS 3	POS 2	POS 1
1st 28 days average	635	375	742	67	47	47
2nd 28 days average	673	485	782	64	45	46
Differences	38	110	40	-3	-2	-1

QSR 5	# of customers			Wait time in seconds		
	POS 3	POS 2	POS 1	POS 3	POS 2	POS 1
1st 28 days average	1090	869	899	45	29	29
2nd 28 days average	982	864	818	41	27	27
Differences	-108	-5	-81	-4	-2	-2

	1st 28 days average	2nd 28 days average	
	Sale Revenue	Sale Revenue	Increase %
QSR1	$ 3,578	$ 3,665	2.40%
QSR2	$ 7,034	$ 7,203	2.40%
QSR3	$ 3,115	$ 3,346	7.40%
QSR4	$ 3,218	$ 3,480	8.10%
QSR5	$ 4,456	$ 4,209	-5.54%

The tables above display data from QSR locations 1-5 and shows data from the 28 days before the implementation of AI-QSR and the data from 28 days after. The total increase in customers for QSR 1-5 are: 118, 7, 182, 188, and -194. It is important to note that location 5 reflected negative customers and negative sales over the prior 28 days primarily due to a national holiday. The sales drop was expected during that time period. The sales period for the other 4 stores did not have a holiday impact and the sales increases were as noted. In terms of percentage of total increase in customers are 4.4%, 0.4%, 11.7%, 10.7%, and -6.7%. In addition, there were improvements in service time of the 5 QSRs, each reduced 1, 0, 5, 6, and 8 seconds. Sales volume also increased after the implementation of AI-QSR for the 4 QSRs: 2.4%, 2.4%, 7.4% and 8.1%. QSR 5 decreased in sales of 5.54% but there is an improvement in services time.

Conclusion:

The study reveals that AI is an effective tool to increase speed of service and sale revenue. With so many QSR options available to customers, every second counts. This study provides conclusive evidence that time savings will increase overall sales volume by improving speed of service. These numbers allow managers to understand and optimize the performance of their staff. Managers can use this information to improve performance of staff and find new methods of operation to increase productivity. This study clearly shows that using business intelligent data and AI is a tool that will pay off.

For further details or concerns, please feel free to reach out to:

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