Design of Company Management Dashboard With Machine Learning Analysis For Optimization of Arcade Game Centre Operations

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Abstract

The growth of the digital entertainment industry, especially arcade game centers, demands an effective and data-driven management system to improve operational efficiency and customer experience. This study aims to design a company management dashboard integrated with machine learning analysis to optimize arcade game center operations. This dashboard is designed to provide real-time data visualization and support strategic decision-making through predictive analysis of machine performance, usage trends, and customer behavior. The research methods used include collecting primary and secondary data from the arcade game center transaction system, designing the system using a waterfall approach, and implementing machine learning algorithms such as K-Means for customer segmentation and Random Forest for machine failure prediction. The results of the study show that the developed dashboard is able to provide relevant and accurate information efficiently, and supports data-driven decision-making. With this system, the company can minimize machine downtime, increase customer satisfaction, and design more targeted promotional strategies. This study proves that the integration between management dashboards and machine learning technology can be an innovative solution for operational optimization in the arcade game center industry. Further implementation is recommended for the development of financial analysis features and integration with customer loyalty systems.

INTRODUCTION

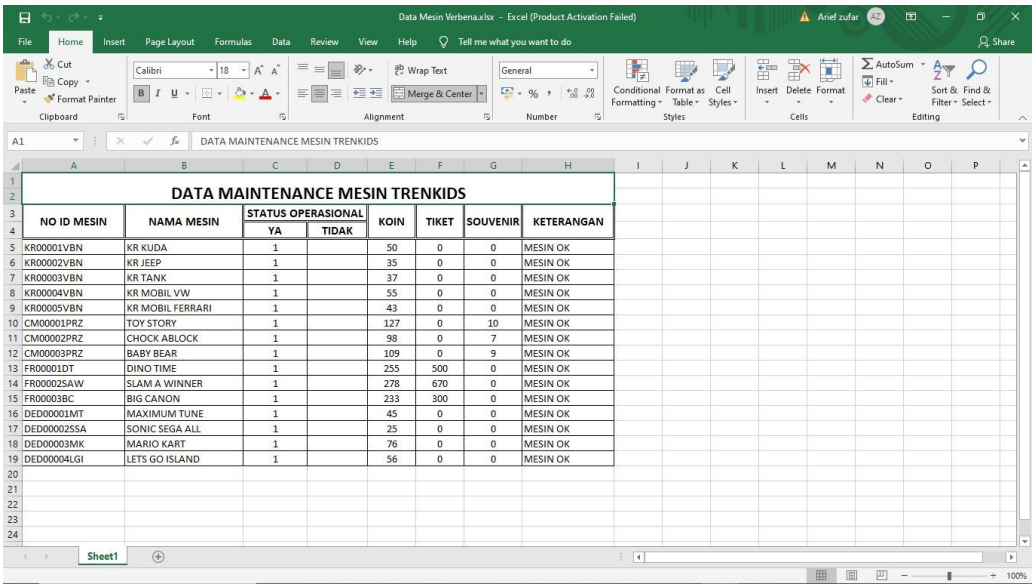
Rapid technological developments over the past few decades have ushered the world into a new era known as the Industrial Revolution 4.0. This term refers to the integration of physical and digital systems through the use of advanced technologies such as artificial intelligence (AI), the Internet of Things (IoT), big data, and cloud computing in various sectors of life. AI not only impacts business operations but also presents strategic business opportunities for developing marketing techniques.(Aini, Dyatmika, Chakim, Khasanah, & Queen, 2025)AI or Artificial Intelligence is capable of processing large amounts of data but only requires short data, detecting patterns, and providing the best recommendations.(Husna, 2025)Digital marketing has many advantages, including reaching a wider market, lower operational costs, and the ability to track the success or failure of a campaign in real time.(Putri, 2025)This transformation has not only impacted the industrial world, but also influenced work patterns, education, the economy, and even the way humans interact on a daily basis.

Amid these changes, the Industrial Revolution 4.0 presents significant opportunities for increased efficiency and productivity. One of the characteristics of the Industrial Revolution 4.0 is the interconnection between humans and machines through the Internet of Things.(Mulyana, 2022)Currently, Indonesia is in the era of the Industrial Revolution 4.0, where business competition, which initially focused on natural resources, has now shifted to how to utilize information technology and work skills.(Kresnadi, Narendra, & Dwinovan, 2023)However, on the other hand, this change also poses serious challenges, particularly in terms of human resource readiness, policy adaptation, and the availability of supporting infrastructure. The 4.0 Revolution

era boasts numerous technological advances and highly accessible sources of information, leading to intense competition. Technological incompetence, or technological illiteracy, is one of the major challenges that must be overcome in this era.(Rahmawati, Apriliani, & Diantara, 2021)Many sectors are being required to digitally transform to remain relevant and competitive, while much of the workforce is still struggling to adapt to new skills demands.

The relationship between the Industrial Revolution 4.0 and machine learning-based dashboard systems is very close, as both emphasize the importance of fast, accurate, and data-driven decision-making. In the modern industrial ecosystem, the existence of such systems not only accelerates information processing but also increases organizational competitiveness through automation and efficient information management.

For example, Company X is running a business in the Arcade Games Arena sector, Company X still runs its business in a conventional way from year to year. The recording is still using the Point of Sale application and then summarized manually into Microsoft Excel to analyze visit data, because the limitations of the Point of Sale system which can only record sales of playing coins or balances for playing, so it cannot track which machines are most in demand by visitors. The only way to find out which machines are most popular is by carrying out routine maintenance on all machines such as refilling prize tickets or souvenirs on the machine. The following is an example of data from a maintenance report on a machine.



DATA MAINTENANCE MESIN TRENKIDS

NO ID MESIN	NAMA MESIN	STATUS OPERASIONAL		KOIN	TIKET	SOUVENIR	KETERANGAN
		YA	TIDAK				
KR00001VBN	KR KUDA	1		50	0	0	MESIN OK
KR00002VBN	KR JEEP	1		35	0	0	MESIN OK
KR00003VBN	KR TANK	1		37	0	0	MESIN OK
KR00004VBN	KR MOBIL VW	1		55	0	0	MESIN OK
KR00005VBN	KR MOBIL FERRARI	1		43	0	0	MESIN OK
CM00001PRZ	TOY STORY	1		127	0	10	MESIN OK
CM00002PRZ	CHOCK ABLOCK	1		98	0	7	MESIN OK
CM00003PRZ	BABY BEAR	1		109	0	9	MESIN OK
FR00001DT	DINO TIME	1		255	500	0	MESIN OK
FR00002SAW	SLAM A WINNER	1		278	670	0	MESIN OK
FR00003BC	BIG CANON	1		233	300	0	MESIN OK
DED00001MT	MAXIMUM TUNE	1		45	0	0	MESIN OK
DED00002SSA	SONIC SEGA ALL	1		25	0	0	MESIN OK
DED00003MK	MARIO KART	1		76	0	0	MESIN OK
DED00004LGI	LETS GO ISLAND	1		56	0	0	MESIN OK

Figure 1 Manual Data Collection

Figure 1.1 above still shows that data is still recorded and processed manually, thus requiring a long time to obtain the desired data. This is not to mention human errors such as forgetting to record, excess or deficiency in manual calculations, and other unforeseen issues. With the long time required to obtain data, management or business actors will certainly need a long time to process the data and obtain the desired data to determine future business steps and strategies.

The above issues can lead to detrimental problems such as decreased profitability due to uncontrolled cost margins, delays in following trends leading to missed business opportunities, and loss of target markets due to the inability to adapt to consumer needs. The right decisions and strategic steps are key to maintaining competitiveness and growth amidst the intense business competition of the Industrial Revolution 4.0.

METHODS

This research uses an experimental approach, a research method designed to examine the effect of a treatment on specific variables under controlled conditions. Through this approach, researchers provide specific interventions to research subjects, then observe and analyze the changes that occur as a consequence of those interventions. This research focuses on how the system obtains data from machine activity, processes it, and categorizes it using machine learning, and uses a dashboard visualization to display the data.

To further in-depth research, the researchers used research materials for this study. The data used was actual machine data at the research location, consisting of the identities of arcade game machines used in the amusement park business area. The following is the machine data:

Table 1 Arcade Game Machine Categories

Machine ID	Machine Name	Category	Tickets	Souvenir
KR00001VBN	KR Horse	Kiddie Ride	NO	NO
KR00002VBN	KR Jeep	Kiddie Ride	NO	NO
KR00003VBN	KR Tank	Kiddie Ride	NO	NO
KR00004VBN	KR VW Car	Kiddie Ride	NO	NO
KR00005VBN	KR Ferrari Car	Kiddie Ride	NO	NO
CM00001PRZ	Toy Story	Prize Game	NO	YES
CM00002PRZ	Chock A Block	Prize Game	NO	YES
CM00003PRZ	Baby Bear	Prize Game	NO	YES
FR00001DT	Dino Time	Redemption	YES	NO
FR00002SAW	Slam A Winner	Redemption	YES	NO
FR00003BC	Big Canon	Redemption	YES	NO
DED00001MT	Maximum Tune	Simulator	NO	NO
DED00002SSA	Sonic Sega All	Simulator	NO	NO
DED00003MK	Mario Kart	Simulator	NO	NO
DED00004LGI	Let's Go Island	Simulator	NO	NO

Table 2 Machine Maintenance Recording Data

Machine ID	Machine Name	Number of Games Played	Number of Exit Tickets	Qty Toys Out
KR00001VBN	KR Horse	50	0	0
KR00002VBN	KR Jeep	50	0	0
KR00003VBN	KR Tank	50	0	0
KR00004VBN	KR VW Car	50	0	0
KR00005VBN	KR Ferrari Car	50	0	0
CM00001PRZ	Toy Story	50	0	5
CM00002PRZ	Chock A Block	50	0	10
CM00003PRZ	Baby Bear	50	0	4
FR00001DT	Dino Time	50	550	0
FR00002SAW	Slam A Winner	50	955	0

FR00003BC	Big Canon	50	457	0
DED00001MT	Maximum Tune	50	0	0
DED00002SSA	Sonic Sega All	50	0	0
DED00003MK	Mario Kart	50	0	0
DED00004LGI	Let's Go Island	50	0	0

OnTable 1 presents data that lists all the machines in one area of the arcade game park. Some of the data includes the machine code, machine name, machine category, and the type of prize dispensed by the machine. This data provides information about the type and identity of the machine.

OnTable 2 shows that the data is data obtained from a routine maintenance cycle in an arcade games playground area, the data was obtained through manual recording by technicians in charge of carrying out maintenance on the machines. The data obtained is the Estimated Machine Played, the Number of Tickets Issued, and the Number of Prizes or Souvenirs issued from the machine to players. This data is one of the main objectives of designing a machine learning-based dashboard system that will be developed, in accordance with the formulation of the research problem in point 1 (first), namely "How to design a management dashboard that is able to display arcade game center operational data effectively and in real-time?"

1. K-Means Clustering

   In implementing a machine learning system using the K-Means method, the aim is to group all the data obtained, for example as follows:

Table 3 Raw Data of 3 Machines from May 1 – 7

Machine Code	Date	Machine Played
KR Horse	2025-05-01	29
KR Horse	2025-05-02	27
KR Horse	2025-05-03	30
KR Horse	2025-05-04	27
KR Horse	2025-05-05	29
KR Horse	2025-05-06	30
KR Horse	2025-05-07	27
Chock A Block	2025-05-01	34
Chock A Block	2025-05-02	32
Chock A Block	2025-05-03	32
Chock A Block	2025-05-04	32
Chock A Block	2025-05-05	33
Chock A Block	2025-05-06	33
Chock A Block	2025-05-07	35
Slam A Winner	2025-05-01	31
Slam A Winner	2025-05-02	35
Slam A Winner	2025-05-03	31
Slam A Winner	2025-05-04	35

Slam A Winner	2025-05-05	34
Slam A Winner	2025-05-06	32
Slam A Winner	2025-05-07	31

Table 3 presents raw data recorded by the system, using the K-Means clustering method, the data will be grouped into data that is easier to understand, with the following example:

Table 4 Report of Machines Played Per Day

Machine Code	Machines played per day	Machines Played Per Week
KR Horse	25	213
Chock A Block	37	301
Slam A Winner	30	250

Obtained from the information presented in table 4, raw data will be grouped into several types of data that are adjusted to the data key or data key applied.

2. ARIMA

In its development, machine learning applications use the ARIMA method to analyze frequency data and estimate future frequency using existing data. Here are some examples of data on visit frequency and machine usage:

Table 4 Frequency of 1-Day Data at One Branch

Machine Code	Frequency of Visits	Frequency of Play
KR Horse	25	1
KR Jeep	38	5
KR Tank	30	252
KR VW Car	23	22
KR Ferrari Car	28	208
Toy Story	24	4
Chock A Block	35	273
Baby Bear	27	26
Dino Time	32	250
Slam A Winner	30	12
Big Canon	19	170
Maximum Tune	40	320
Sonic Sega All	33	3
Mario Kart	26	210
Let's Go Island	22	183

Table 5 Previous Day's Data on Related Branches

Machine Code	Frequency of Visits	Frequency of Play
KR Horse	22	2
KR Jeep	36	8
KR Tank	28	245
KR VW Car	25	23
KR Ferrari Car	29	190
Toy Story	22	3
Chock A Block	34	270
Baby Bear	26	30
Dino Time	31	248
Slam A Winner	32	15
Big Canon	18	166
Maximum Tune	39	325
Sonic Sega All	34	4
Mario Kart	27	198
Let's Go Island	23	176

Table 4 shows data from one play area over a 1-day period, and Table 5 shows data from the previous day in the same play area. The ARIMA formula used is:

$$yt+1=2yt-yt-1$$

Then it is adapted to the programming language used, namely PHP, so that it becomes the following formula:

```
foreach ($machine as $code => [$y_t_1, $y_t]) { $prediction = 2 * $y_t - $y_t_1;
echo "$code is predicted to be played tomorrow: $prediction times "; }
```

So that it produces data like the following:

Table 6 Estimation Using ARIMA Method

Machine Code	Predictions to be played tomorrow
KR Horse	$2 \times 1 - 2 = 0$
KR Jeep	$2 \times 5 - 8 = 2$
KR Tank	$2 \times 252 - 245 = 259$
KR VW Car	$2 \times 22 - 23 = 21$
KR Ferrari Car	$2 \times 208 - 190 = 226$
Toy Story	$2 \times 4 - 3 = 5$
Chock A Block	$2 \times 273 - 270 = 276$
Baby Bear	$2 \times 26 - 30 = 22$
Dino Time	$2 \times 250 - 248 = 252$

Slam A Winner	$2 \times 12 - 15 = 9$
Big Canon	$2 \times 170 - 166 = 174$
Maximum Tune	$2 \times 320 - 325 = 315$
Sonic Sega All	$2 \times 3 - 4 = 2$
Mario Kart	$2 \times 210 - 198 = 222$
Let's Go Island	$22 \times 183 - 176 = 190$

3. Time Series Forecasting

After knowing the predicted number of machine ratios played each day, researchers also used Time Series Forecasting to find out which playing machines were the most popular and least popular with the following data:

Table of 7 Most Popular Gaming Machines

Machine Code	Yesterday	Today	Information
Dino Time	245	252	High consistency
Chock A Block	270	273	Very stable
KR Tank	248	250	Consistently liked
KR Ferrari Car	166	170	Increase
Mario Kart	198	210	Significant increase
Let's Go Island	176	183	Steady rise
Maximum Tune	325	320	Still the highest despite the decline

Table 8 Less Popular Gaming Machines

Machine Code	Yesterday	Today	Information
KR Horse	2	1	Almost no interest
Dino Time	8	5	Interest continues to decline
Toy Story	3	4	Slightly up, still low
Sonic Sega All	4	3	Not attractive
Slam A Winner	15	12	Decrease in interest
Baby Bear	30	26	Tends to decrease

Table 9 Machines With Standard Interest

Machine Code	Yesterday	Today	Information
KR VW Car	23	22	Low Stable
KR Ferrari Car	190	208	Up but not high yet

Once the data is categorized, management or business owners can identify market trends that are currently attracting visitors. This allows them to quickly determine strategic steps to follow market trends and maintain their business's existence.

RESULTS AND DISCUSSION

After conducting research and development on the integrated system, researchers succeeded in creating an application system that makes it easier for the management of the Arcade Game Center to manage the business so that it is more efficient and can make more strategic decisions, so that they can determine the right steps in taking each business action.

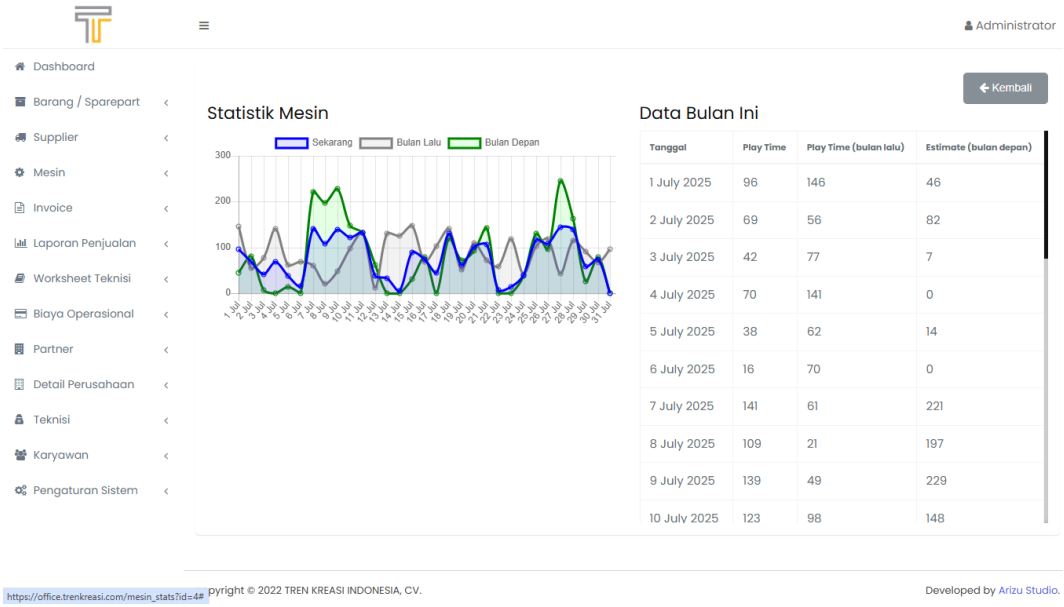


Figure 2 Machine Statistics Report

Figure 2 presents a set of data successfully recorded or automatically recorded by the developed system. The data displayed consists of two types: a graph and a data table. The traffic data is a simulation of a more human-friendly data display so that users can understand each item displayed. The tabular data presents more raw data and may be difficult for users to understand, but is still needed for reporting purposes. The data displayed includes all dates for the current month, all dates for the previous month, and predicted data for all dates for the following month using the Arima algorithm.

CONCLUSION

Based on the results of the design, implementation, and evaluation of the dashboard system equipped with machine learning analysis, the following conclusions can be drawn:

1. The developed dashboard system successfully presents arcade game center operational data visually, interactively, and in real-time. This helps management monitor machine performance, visitor numbers, and revenue.
2. Machine learning integration in the system provides added value in the form of insights:
    - K-Means clustering successfully grouped arcade player types based on playing behavior, thus facilitating customer segmentation for promotional strategies or service improvements.
    - ARIMA is able to predict the number of daily visitors in the future, which is useful for decision making such as hiring additional staff, scheduling events, or machine maintenance.

The development of a dashboard system integrated with machine learning enables faster and more significant data processing compared to conventional methods. Automated information collection simplifies management processes. Furthermore, the integration of machine learning systems allows the system to learn from data, classify data, and make predictions about the future.

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