

## **The Analysis Of The Journal**

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### **Title Of Journal**

## **DEVELOPMENT OF SMART ADVERTISING MEDIA BY IMPLEMENTING SYSTEM INTERACTION ADS USING INTERNET OF THINGS**

The analysis of the Journal below is as follows:

### **1. Background Of the Research**

Media advertising serves as a platform for disseminating product information to consumers, with various types including print and online media, and placements ranging from indoor to outdoor. Different media types, like social media, offer more interaction compared to indoor advertising, which generally lacks features for user feedback and interaction

### **2. Research Question(s)/Purpose of the Research**

The purpose of this research is to apply IoT-based technology to advertising media, aiming to create a system that is interactive, monitored, and capable of retrieving necessary information for advertisers. The study seeks to develop a smart advertising medium that improves product branding and ensures customers see the displayed information

### **3. Literature Review/Theoretical Framework**

Indoor digital ads typically display static content without the ability to gather important consumer data or provide real-time feedback. This limitation poses challenges in determining how many consumers notice the ads and understanding their responses. The integration of IoT in advertising can address these issues by enabling data collection on user interactions and preferences. MQTT (Message Queuing Telemetry Transport) is highlighted as an efficient protocol for IoT applications due to its suitability for low-bandwidth communication. Prior research by Hidayet Aksu et al. indicates that 98% of advertisements require systems capable of gathering such data to evaluate consumer engagement effectively. Utilizing components like cameras for computer vision, the Internet for connectivity, and Raspberry Pi for processing, the proposed system aims to enhance indoor advertising by providing interactive features and comprehensive data collection capabilities.

### **4. Methodology**

- Method: Quantitative research methodology.
- Site: Indoor settings where digital advertising media are used.
- Object of the Research/Participants/Respondents: Indoor digital billboards and their interaction with consumers.
- Instruments for Collecting the Data: Cameras and sensors connected to the IoT system, data collection software to monitor and analyze interactions
- Analysis Method: Statistical analysis of interaction data collected from the digital billboards to evaluate the effectiveness of the advertisements and consumer engagement.

## 5. Result/Findings

The research resulted in the successful development of a smart advertising system using the Internet of Things (IoT). The system was able to control and monitor media remotely as long as it was connected to the internet. It provided detailed information about advertisements, including data on how many people interacted with the ads and their preferences towards the content. Moreover, the system allowed advertisers significant freedom in creating and customizing video content to suit their needs. The system's flexibility and interactive capabilities represented a substantial improvement over traditional indoor advertising media, which lacked interactivity and data collection features

## 6. Conclusion

The IoT-based advertising system developed in this study proved effective in enabling remote control and monitoring of advertising media. It not only facilitated the collection of valuable interaction data but also allowed advertisers to customize content dynamically. For future improvements, the system could incorporate features such as face recognition, enhanced computer vision capabilities, and more flexible design tools to further optimize the advertising experience

# DEVELOPMENT OF SMART ADVERTISING MEDIA BY IMPLEMENTING SYSTEM INTERACTION ADS USING INTERNET OF THINGS

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## ABSTRACT

Development of Smart Advertising Media By Implementing the System Interaction ads using the internet of things is a study aimed at improving advertising media in the room by implementing system interaction ads that enable media to interact with consumers and obtain information from the media that is built. Media built can provide information about advertising to advertisers in the form of number of interactions and number of likes. This media uses component standards that must be owned, among others, is a camera as a support for computer vision technology programmed using the Opencv library, the internet as a supporter of internet of things that uses the MQTT protocol as sending and receiving data, then ultrasonic which aims to obtain data distance between media and objects in front of it, as well as the raspberry pi 3 model b which functions as a mini computer on the media that is built that aims to display advertising content. This media is placed indoors and the installation of advertising content is done through the web, and information about advertising will be sent to the web to be checked by advertisers. for advertising to devices and sending data from the device to the web and saved to the database has been tested. as a whole the media that was built and the system that was implemented has been successfully operated.

**Keywords :** Internet Of Things, Advertising, Advertising Media, MQTT, Computer Vision

## 1. INTRODUCTION

### 1.1 Background

Media advertising is a place where information about products is distributed to consumers, of course the advertising media which is different from print media to online media, the placement also varies starting from indoor to outdoor [1]. Different features of each media such as social media have more interaction than indoor advertising, for example, Instagram, Instagram can be used as an advertising medium that has interaction, unlike the case with indoor media that only has the feature of displaying images or videos without any interaction or feedback from the user. For comparison between the advantages of social

media features and the features of indoor media can be seen in the following table:

**Table 1.** Feature Comparison

MEDIA NAME	INTERACTION	FEEDBACK	FLEXIBILITY
INSTAGRAM	√	√	√
INDOOR ADVERTISING MEDIA	X	X	X

Media advertisements in the installed room still have disadvantages in terms of providing information to advertisers. From the results of research conducted by Hidayet Aksu et al. entitled "Advertising in the IoT Era: Vision and Challenges" [2] found data that 98% of advertisements require a system of retrieving information from the media available about how many consumers pay attention to the advertisements that are installed, and knowing feedback directly from consumers [3] [4]. Whereas from the observations made to the research media that is researched and widely used, namely indoor digital billboards, the components in the media only support the display of advertising content, without being able to store important data obtained from consumers that make it possible to be informed.

Indoor digital ads are static ads that have content about temporary promos or notifications [5]. To advertise its products, the installation of content requires a client computer that displays images or videos on a digital advertising screen, with a large and hidden computer size, the difficulty is consuming time and space, if advertisements that are marketed are flash promos that allow replacement of ads quickly, of course this will make admin difficult to change content. Then indoor digital advertising does not support monitoring through any device, because the focus of digital advertising in the room is to display content and there is no monitoring to find out whether the ad is being displayed, is jammed or even the ad is not displayed. the ad has a problem so it will make the ad can't be displayed or operate as it should.

Based on the above problems, it requires an advertising medium that can provide interaction in product advertising to improve product brands and

ensure customers see information from advertisements displayed, and get the data needed by advertisers, and use technology that supports media access wherever and whenever namely internet of things.

## 1.2 Purpose and Objectives

The purpose of the research carried out is to apply IoT-based technology to advertising media that are principled, monitored, and can retrieve information needed by ad owners.

While the desired goals of the development of smart advertising media include:

1. Build an interactive indoor advertising media
2. Build a new advertising system that has been integrated online both for media usage or data processing

## 1.3 Research Methodology

The research methodology used in this research is quantitative research methodology. The purpose of quantitative research methodology is descriptive research methods and prioritizes analysis as the basis of research [6]. The research methodology used is as follows:

### 1. Literature Study

Data is collected by reading the results of the research in question with matters examined through journals, papers and books.

### 2. Observation

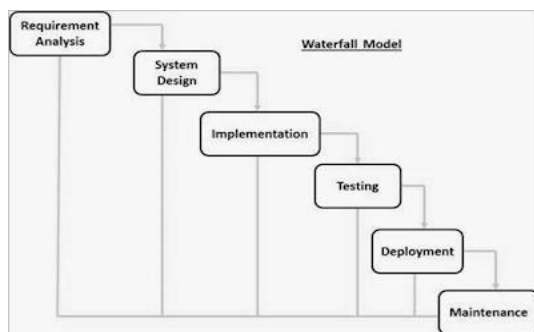
Collect data by observing objects directly

### 3. Interview

Collect data by making questions related to research

## 1.4 Software Development Method

The method of building software used is waterfall. Waterfall is the development of software with linear and sequential processes [7] [8]. Which can be in the picture below.



**Figure 1.** Alur Penelitian

Below is a presentation on Figure 1 about the soft war builder method used:

### 1. Requirement analysis and definition

In this stage the author searches for data and information related to the research, this step is done to understand the system that will be built in this study, namely system interaction ads, one example is the author makes observations, and looks for journals to support research. All information and

data obtained will be used as the basis of research to build the system needed

### 2. System and software design

The next stage is to start the system design that has been ascertained in the previous stages, the design of media devices and also the functional requirements of the software needed by the system to be built, namely system interaction ads.

### 3. Implementation and unit testing

Implementation testing is carried out after the completion of the process, then the development of hardware or media is carried out and the software coding is done at this stage. All needs are adjusted to the provisions specified in the previous stage

### 4. Integration and system testing

After the media and system have been built, the next step is to test both of them to ensure their compatibility with the initial design. In this stage, testing of the media is built and the software is made

### 5. Operational and maintenance

At this stage the media and systems that are built, are carried out maintenance in order to see errors that occur during the operation of the device, both in terms of software and hardware.

## 2. Content of the Study

### 2.1 MQTT

MQTT is a simple protocol, which aims to handle communication from low bandwidth. This is what makes the MQTT protocol very suitable for use in internet of things technology, because it does not require large bandwidth to exchange data.

The workings of mqtt are grouped into 3 categories including PUBLISH, SUBSCRIBE, MQTT BROKER. Publish aims as one of the parties that sends data or data source for other devices in the MQTT protocol, then subscribe, subscribe is a description that the device functions as a data receiver or data taker on the MQTT network, subscribe here to get data from the device that becomes publisher. MQTT Broker is a server that aims as an intermediary between subscribers and publishers in order to communicate with each other, mqtt brokers provide communication channels called TOPIC the purpose of the topic is a unique path code that allows subscribers and publishers to communicate using their own lines so that data is used not confused with the sub and other pubs [9]. MQTT also has the selection of QoS from 0-2 using the Asynchronus Transfer Model [10] network type which can ensure the level of certainty of data reception at MQTT.

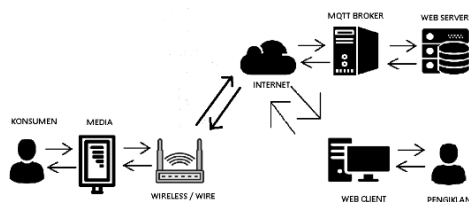
### 2.2 PPS Algorithm

PPS or (PLAY, PAUSE, POSITION SET) algorithm is an algorithm that is intended for video playback with certain conditions, the PPS algorithm has the advantage of playing video, stopping it and heading to certain positions according to the user's wishes, the purpose of this algorithm is to provide free use of video multimedia-based programming.

**Table 2.** Data Analysis in the PPS Algorithm

AKSI	KETERANGAN
Get.timeLength	Take the number of seconds on the video
Get.timeTruePlaying	Retrieving Interaction Data True
Get.timeFalsePlaying	Taking False Interaction Data
Get.timeTruePlaying- Get.timeFalsePlaying	To get the duration of the video interaction false takes place
Get.timeLength- Get.timeTruePlaying	To show how long true video lasts
If Get.timeLength = Get.timeTrueplaying then Set_position(Get.timeLenght- get.timeLength)	To reverse the position of the video to the beginning

### 2.3 System Achitecture To Be Built

**Figure 2.** System Achitecture To Be Built

The architecture that will be built is a description of the foundation of the entire system to be built, in this study the system architecture that will be built is divided into two first explanations when the media installs data into the media and when the media provides data to advertisers, the first explanation is as follows:

1. Customers put advertisements through webclient
2. Positioned advertisers as publishers send data using the protocol mqtt to the specified topic
3. MQTT brokers check whether the MQTT ID and the topic in question are valid
4. If not, the websocket will immediately close and notify that the topic is invalid, if so

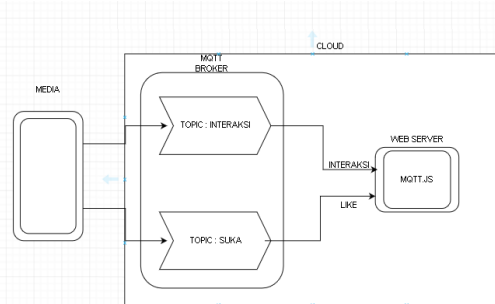
5. Then the topic will save data from the publisher on the broker mqtt
6. The media will repeatedly check whether the data in question exists or not, if the data is not there then the subscriber will repeat continuously until the data is found
7. If the data is found by the media that is the subscriber, then the data will be used as advertising information

The second explanation regarding when the media sends data to advertisers is as follows:

1. Media Waiting for interactions related to advertising
2. The media sends data to the topics available on the broker's mqtt to be stored, at this stage the media becomes a publisher
3. Webclient who are subscribers repeatedly look for information on topics that are subscribed
4. If webclient receives data from the topic on the broker's mqtt then the webclient will display data about the advertisements sent by the media.

### 2.4 Data Communion ArchitectureAnalysis

This analysis includes how data communicates in the research that is built. Data communication that is built is based on mqtt rules, namely data communication based on subscribers and publishers to the topic on the broker mqtt. In this study, the media that became publishers and subscribers were both webclient and media. Webclient becomes a subscriber when it comes to receiving data from media, and becoming a publisher when sending advertising information. While the media became a subscriber when getting data about advertising while becoming a publisher when the media sent advertising data. The description of when the media becomes a publisher and subscriber and webclient as a publisher and subscriber is as follows

**Figure 3.** Media Publisher and Webclient Subscriber

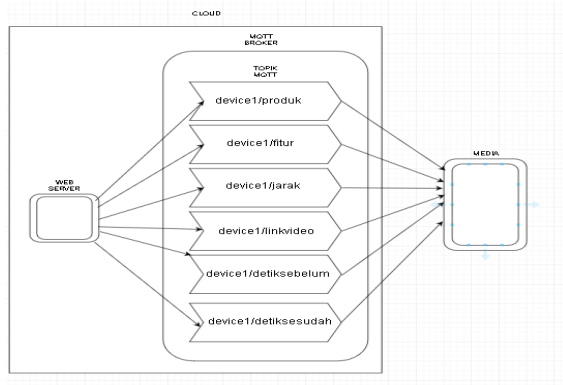
In the above stages it can be seen that Media becomes a publisher when sending data about advertising to data that can be seen in the following table:

**Table 3.** Topic Data on Media

TITLE TOPIC	TOPIC
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DEVICE1	/INTERAKSI
DEVICE1	/SUKA

Whereas below is an illustration when webclient becomes a subscriber and the media becomes a publisher.



**Figure 4.** Publisher Web Client and Media

In the picture above webclient sends data to the topic that can be seen in the following table:

**Table 4.** Topic Data on the Web Client

TITLE	TOPIC
DEVICE1	/PRODUK
DEVICE1	/FITUR
DEVICE1	/JARAK
DEVICE1	/LINKVIDEO
DEVICE1	/DETIKSESUDAH
DEVICE1	/DETIKSEBELUM

## 2.5 Interaction Ads System Components

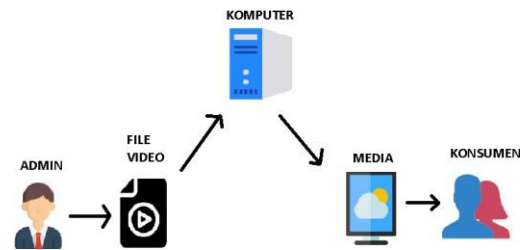
The System Interaction Ads component is a component that is needed in the course of the system to be built, which can describe what the system is meant to be, the components owned by system interaction ads can be seen in the following table

**Table 5.** Interaction Ads System Components

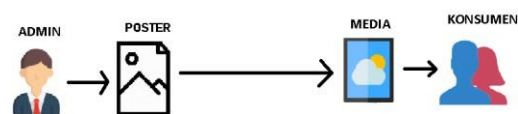
Nama	Tujuan
Web Client	Store data on advertising
Computer Vision	Support the effectiveness of advertising because it can detect and choose consumers
Internet Of Things	To control and manage advertising media

## 2.6 Architecture System Who Have Running

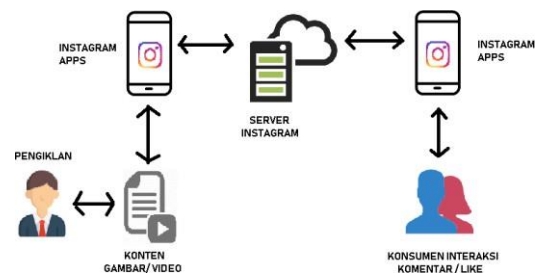
The ongoing system analysis in this study is divided into 3 systems, the first 2 are systems that are running in the ad viewer, and the last is the system that is running on Instagram as an interaction comparison, below in Figure 5 is a system that is running on the media indoor advertising using a PC and in picture 6 are images in a room without a PC, and Figure 7 is an interaction on Instagram.



**Figure 5.** Architecture System Who Have Running on PC



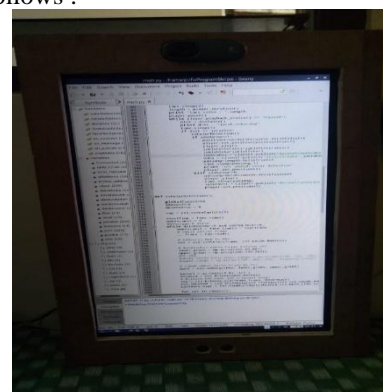
**Figure 6.** Architecture System Who Have Running Without PC



**Figure 7.** Architecture Interactive System on Instagram

## 2.7 Device Design

The device built is advertising media that supports the detection, interaction and viewer of content, the components in the media that are built are as follows :



**Figure 8.** Device Design

Because research builds advertising media in the room, the design that is built is made as much as

possible so that it is not too large, so that it can be placed anywhere, in the device design above for an explanation of the components divided into 3 parts first:

**Table 6.** System Interaction Ads Components

Part	Purpose
Top	Camera
Middle	LED 19 inch
Bottom	Ultrasonic Sensor

## 2.8 Built-in Media Features

The media that is built is in addition to acting as a viewer there are also several other things such as distance detection which aims to ensure the distance of objects with media, the camera as monitoring objects around the media. After this system is built the features available on this media include the following:

**Table 7.** Computer Vision Features

Fitur	Tujuan
Color Detection	Intended to detect colors that are in accordance with the wishes of advertisers
Hand Gesture	Aim to trigger the movement of content in advertisements
Age recognition	This feature is specifically for products that need to know how old it is to interact with the media
Gender Recognition	Aim to ensure the gender of consumers who interact with the media to find matches for the content that has been installed

So that the presence of these features affect changes in content on the media, which helps advertisers to ensure the target user of the product that will appear.

## 2.9 Test Plan

The test plan is the stage that is carried out to check while ensuring that the system being built is appropriate or not. This is intended to ascertain whether the system is built in accordance with the requirements or stipulated conditions from the beginning, the planned testing is to use blackbox.

**Table 8.** Test Plan

Test Item	Test Details	Type of Testing
Login	Verify Username and Password	Blackbox
Register	Verify Username and Password	Blackbox
Index	Choose an advert menu	Blackbox
Cek	Select the advert check menu	Blackbox
PasangIklan	Verifikasi produk	Blackbox

	Verify feature	Blackbox
	Verify detikTrue	Blackbox
	Verify detikFalse	Blackbox
	Select Save Data	Blackbox
	Choosing Connection to mqtt	Blackbox
CekIklan	Choosing Connection to Mqtt	Blackbox
	Select Save Database	Blackbox

## 3 FINALE

### 3.1 Conclusion

From the results of research conducted which has passed the implementation and testing stages, the authors draw the conclusion that in the research and development of internet of things-based systems for advertising, namely:

1. The system built can control and monitor media wherever and whenever it is connected to the internet
2. The system built can provide information about advertisements installed, such as how many people interact with advertisements and how many people like content
3. The system built provides freedom in creating videos in accordance with the wishes of advertisers

### 3.1 Suggestion

To maximize the system that will be built, of course development is needed as a writer, of course, there are still a lot of lacks in the development of iot systems related to advertising, therefore the author summarizes some suggestions that can be used as a reference for further research with the same topic:

1. Using face recognition that aims to make the same user not see ads twice that can streamline advertising
2. Using double computer vision features, to add interaction
3. Ensure media distance with users only by using computer vision
4. Design tools that are simpler and more flexible

## BIBLIOGRHAPY

- [1] Jimmy Schaeffler, "Digital Signage", Focal Press Media Technology Professional, ISBN: 978-0-240-81041, 2009.
- [2] Hidayet Aksu, Leonardo Babun, Mauro Conti, Gabriele Tolomei and A. Selcuk Uluagac, "Advertising in the IoT Era: Vision and Challenges", Department of Electrical and Computer Engineering Florida International University, Miami, FL, USA. Januari 2018.
- [3] Taner Arsan, Alp Parkan and Hakkı Konu, "Design and implementation of remotely managed embedded digital signage system", International Journal of Computer Science, Engineering and Applications (IJCEA) Vol.4, No.3, Juni 2014.

- [4] Umakant B. Gohatre, V. D. Chaudhari, " Digital Advertising of Still and Moving Images using Raspberry Pi", International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV4IS020549 www.ijert.org Vol. 4 Issue 02, Februari 2015.
- [5] J. Müller, J. Exeler, M. Buzcek and A. Krüger, "Reflective Signs: Digital Signs That Adapt to Audience Attention," in 7th International Conference Pervasive Computing (Pervasive 2009), Nara, 2009.
- [6] R. S. Pressman, Rekayasa Perangkat Lunak: Pendekatan Praktisi Buku I. Yogyakarta: Andi, 2012.
- [7] Bassil Y., "A Simulation Model for the Waterfall Software Development Life Cycle", International Journal of Engineering & Technology (iJET), 2012.
- [8] Rizky Soetam, Konsep Dasar Rekayasa Perangkat Lunak. Jakarta: Prestasi Pustaka, 2011.
- [9] Raj Jain, "Messaging Protocols for Internet of Things: MQTT", 2015. [Online]. Tersedia: [https://www.cse.wustl.edu/~jain/cse570-15/ftp/m\\_14mqtt.pdf](https://www.cse.wustl.edu/~jain/cse570-15/ftp/m_14mqtt.pdf). [Diakses: 1 Maret 2019].
- [10] M. Ariefiandi Nugraha dan Eko Budi Setiawan, "Quality Of Services (QOS) Pada Jaringan Asynchronous Transfer Mode", Jurnal Ilmiah Komputer dan Informatika (KOMPUTA) ISSN: : 2089-9033 Vol.2, No.1, Maret 2013.