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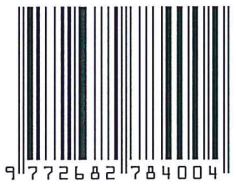

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LOGAN MULTI-FUNCTIONAL DIGITAL CLOCK

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ABSTRACT

The term "reverse engineering" refers to an activity that is a process step by step by which the details design of a product is analysed, study, observe or redesign using a physical part as a starting point. This paper presents results of a study about re-design an existing digital clock through reverse engineering process and giving a new meaning of usage and form without changing the internal component of the digital clock product. Nowadays, people relies on alarm clocks to start the day. Digital clocks are becoming too popular because their advantages make it easy for you to check the time quickly, accurately and correctly. **Logan** multi-functional a digital clock is a type of clock that displays the current time with a digital method in 12 hour format as HH:MM:SS. This product features a multifunction 6 in 1: clock, alarm clock, temperature, calendar, timer and the light of the clock will get on by clapping. To see the current time, just tap the snooze button and you'll get five seconds of time shown. A built-in night light allows easy viewing of the time in the dark with a gentle hit on the table within the range of 1 meter by touching any place on product, in convenience of reading the time at night. Then, the light will automatically go off in just 5 seconds. This product with Temperature Humidity Sensor can accurately detect the temperature and humidity in your house. This product features a large display with oversized red numbers against a black LED display. The time can be set 12 hours or 24 hours easily or see time from a distance hands free. This clock uses Triple A Batteries. This product is specially designed for teenagers to help them normalize their sleep schedule and help them focus on getting the shut-eye. Plus, this product ensures them wouldn't miss out on important meeting or classes, so they can snooze away peacefully. This product is designed with three colour combination from black, merlot and alloy orange. These options are for users to pick which one suits their room better. This product is made out of ABS Plastic which also known as Acrylonitrile Butadiene Styrene as it is widely used in electronic housings, auto parts, consumer products, pipe fittings, Lego toys and more. This multi-functional device is ideal for traveling due to its compact and handy size.

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1. INTRODUCTION

Written by Ian Wills; Updated January, 2019. Reverse engineering is such common engineering technique that many of us adapt to on a daily basis, even if we are unaware of its use. The purpose of reverse engineering is to deduce design decisions from end products with little or no additional knowledge about the procedures involved in the original production. It often involves taking something (e.g. a mechanical device, electronic component, or software program) apart and analysing its workings in detail, used in maintenance or to try to make a new device or program that does the same thing without copying anything from the original.

It often involves taking something (for example a mechanical device, electronic component, or software program) and analyzing how it works in details, using it in maintenance or to try to create a new device or programme that does the same thing without duplicating anything from the original product.

Nowadays product design produces rapidly in variety of forms, functions and themes and shorten products' life cycles, it is crucial to reduce the product development time to maintain competitiveness in the market. There are eight critical point of views or quality categories that can serve as a framework for strategic analysis: performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality (Garvin, 1987). In studies (Pujara and Chaurasia, 2011) showed that young consumers, agre range between 15-18 chose physical features in products which include design, fit, appearance and comfort which matters a lot beside the basis quality.

The rationale behind the Logan's multi-functional digital clock design is that the brain is stimulated to the point that it's telling your body "it's time to get up,'' which allows for a much more natural morning experience. This product is designed with elegant look and there's nothing difficult about operating this clock. Whether it's for teenagers, this is as basic as it gets. The ultra-portability function as a smart option for travellers who need something that can fit into a suitcase and easy to carry.

The problems of the existing multi-functional digital clock Is it looks bulky. In term of appearance, the design is too classic and has lack of attractions among teenagers because they are expecting for a better design.

The problems of the existing multi-functional digital clock can be solved by creating a new multi-functional digital clock design that can be widely used among teenagers so that they can learn to start managing their schedules effectively. This product also can help them start to learn responsibility and begin to learn to get up. To get ready and to get out of the door on time in the mornings. This product is also different from the existing multi-functional digital clock where it is made out of ABS Plastic and is widely used in industries because of the characteristic of plastics itself that has a criteria of toughness, high wear resistance, high impact resistance, easily processing and corrosion resistance.

In conclusion, this multi-functional digital clock is a great option and ideal for teenagers as it can help them to wake-up early in the morning nd be on time on time. This basic alarm clock for teens also comes with three different colour options and covinient for travelling. This alarm clock features all the expected features such as clock, snooze, customized alarm settings, temperature, timer, calendar and a loud alarm clock. In addition, people do not have to be worried of this product as this product will sove the problem. Last but not least, with embossed logo printing, the researcher will be able to give invitations an interesting texture

that encourages anyone to pick up and hold it. This also will attract consumer's attention and help to raise awareness of the brand.

2. DESIGN CONCEPT

Klein, Moon, and Hoffman (2006) describe sense making or new developments as "a influenced, repeated effort to understand connections (which can be among people, places, and events) in order to interpret the development of ideas and act effectively. Design Concept includes the activities that commence from a design brief — that is, a description of what to do, defining the problems, study the existing branding or product and the decision making. The activities are to identify needs, establish target specifications, select, and determine the concept of a product.

LOGAN multi-functional digital clock is based on Hi-tech style especially for teenagers. The problems of the existing multi-functional digital clock are the size of the clock is bulky and difficult to hold for those who has small hands. In term of appearance, the design is too classic and has lack of attractions among teenagers. Other than that, the objectives of this design are to apply the suitable material that are more durable, to give it a non-slippery surface on the product to make it easier for users to carry and to make it bolder and tough that reflect the nowadays lifestyle of nowadays teenager. The design criteria are hi-tech, lightweight, less bulky design, ergonomically in handling and texture friendly. The target user is for teenagers.

Figure 2.1: *Logan Multi-Functional Digital Clock*

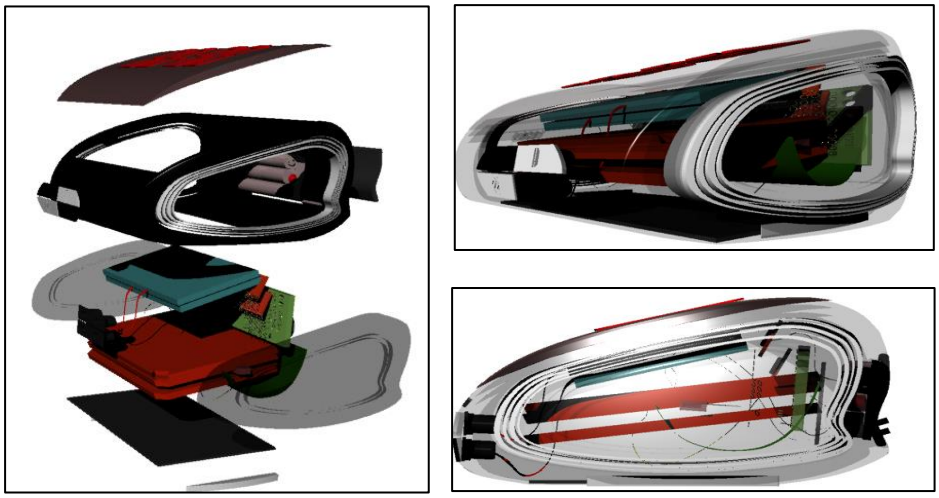

Figure 2.2 : Transparent/ see-through and exploded view of Logan Multi-Functional Digital Clock

3. METHODOLOGY

Observation is the process, techniques and method of watching someone or something. Often, observation is an informal action, but it can also be formal and involve data collection. An observation can also be the collected information itself. For the methodology process, they are few stages that have been involved in this project (Figure 3.1: Flow Chart of Methodology).

Face to face interviews have been conducted to 4 respondents age 19-25 regarding to performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality of existing digital clock. Role play also conducted through interviews between researcher and respondents to get information regarding selected digital clock.

Next, the final mock–up of LOGAN Multi-Function digital clock is reviewed by 13 respondents age 20 to observe respondents' opinions on aesthetic value and perceived quality based on chosen partial style, Hi-Tech. Final product of LOGAN Multi-Function digital clock completed after mock-up development amendments from peers' mock-up reviewed.

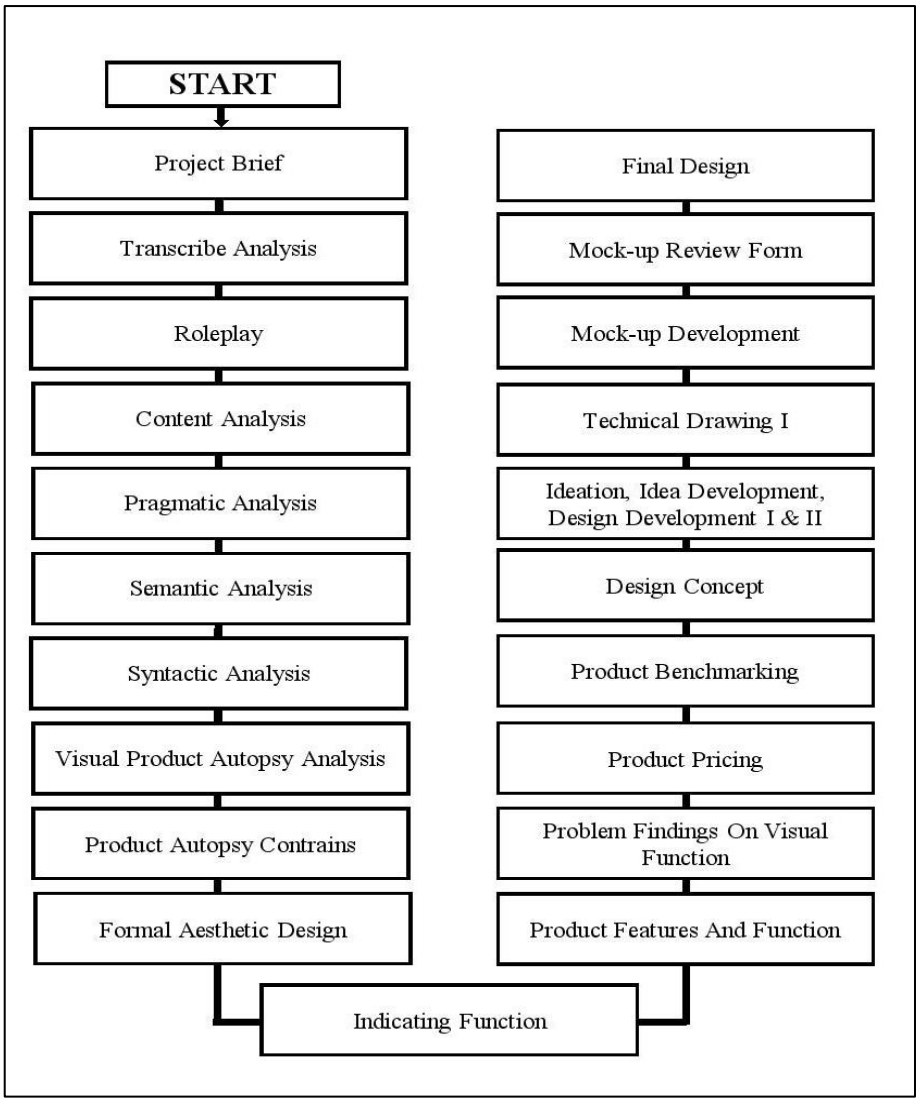

Figure 3.1: Flow Chart of Methodology

3.2 Transcription is the action of providing a written account of spoken words. In qualitative research, transcription is conducted of individual or group interviews and generally written verbatim (exactly word-to-word). Qualitative data collected as audio-visual recordings are ideally transcribed as textual files for archiving and sharing. Consider transcribing conventions, instructions, guidelines and a template to ensure quality and consistency across a data collection. Hereby is a transcribe analysis from respondent regarding the study of existing multi-function digital clock

TRANSCRIBE

NIK NUR ANEESA BINTI ZAMZURRI
2018698326
KAD 114 4C

LOGAN

The conversation was recorded between buyer (A) and the seller (B) on Sunday, 23/02/2020 at 5:45 pm at MR **DIY** outlet **Central Square,** Sungai Petani.

A: Assalamualaikum, seller.
B: Waalaikumsalam.
A: I came across this beautiful alarm clock near the shelf on the left. I want to buy this alarm clock because this watch looks gorgeous.
I need this clock for my assignment. Then, could you please explain about this watch a little?
B: Yes, of course. Okay, first of all, this watch requires three Triple A batteries. Okay, let's install it.
(The seller installs the battery on the clock)
A: Okay, seller. Wow, it has a cute sound.
B: After we insert in the batteries into the clock, it will make a sound, and that was normal. You have nothing to be worried. Okay, then there is a button below, press it, and the sound will automatically stop.
A: Oh, okay. So, is there any function of this clock other than being able to show the time of the clock?
B: Okay, this clock is also able to show the month, temperature reading and so on. Then we can choose the time format either 24 hours or 12 hours.
A: Is this the only shape that we can get from this shop?
B: For the time being, yes.
A: Oh, so this is the latest?
B: Yes, it is.
A: Okay, so what about the colour? Does this store only have this black-flagged alarm clocks?
B: There is another colour, which is white. Do you want to see?
A: Sure.
B: Okay, wait a second.
A: Alright.
(After a few seconds)
B: Okay, this one is white.
A: Wow, this white colour is also beautiful. This colour also looks more attractive than the previous one. It looks more elegant.
B: I know, right. It looks better than the black one, right?
A: Em, may I see it?
B: Yes, sure.
A: Can I turn on this watch?
B: Sure, you can.
A: Oh. So if I press this, what will happen?
B: Okay, let's give it a try. It will turn off the lights.
A: Oh, I see.

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TRANSCRIBE

NIK NUR ANEESA BINTI ZAMZURRI
2018698326
KAD 114 4C

LOGAN

B: Okay, this light is not just coming out this way. Even if we lift it, it still can glow.
B: Besides, the clock can also light up by just clapping your hand. Look at me doing this.
(Clap clockwise)
A: May I try? Hahaha.
B: The price is reasonable and worth buying.
A: Oh. So if I buy this clock, what is the advantages that I could get when purchasing this?
B: The advantage is, it will make it easier for you to look at the clock in the night. There is no need for you to reach for your mobile phone to know the time. This watch is lightweight and can be carried anywhere because of its small size and compact
B: You are also studying, right?
A: That's right. I'm still learning. With this clock, I can use it at the hostel.
B: Right.
A: If so, I want to buy this alarm clock.
B: Sure, thank you so much.
A: Okay.
B: Do you want to purchase its battery?
A: Is the battery expensive?
B: You have to add a little.
A: Oh, I see. Okay, I want it.
B: Do you want the expensive one or the cheap one?
A: The cheap one, as I'm still studying. Thank you, seller.
B: You are welcome.

CONCLUSION

This suare digital clock is just the same as the standard you get and you can put on your bedside table. It is 157 mm tall and 87 mm thick. From left to right it measures 157 mm and weighs in at 209 gm. Half the front surface of the clock is taken up by the LCD screen while the other half is left empty. The clock casing is painted black and made out of plastic. The clock comes in one operate piece. It consists of the clock itself while the other is the metal legs. The clock is powered by triple A batteries. The functionality of the watch is rather simple. Apart for the time and calendar, it has any other multifunctions such as , alarm clock, temperature, calendar, timer and the light of the clock will get on by clapping

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Figure 3.2: Transcribe Analysis

3.3 Role-play exercises enable the implicit knowledge of experts which then can be used to identify and refine UX-related factors in product ideas (Winter, 2016). Experiences from role-playing between participant and researcher can contribute to create ideas to build new design.

ROLEPLAY

NIK NUR ANEESA BINTI ZAMZURRI
2018698326
KAD 114 4C

LOGAN

Nik: Hi guys, so I have bought an alarm clock. Now, I want to ask you all what you think about this alarm clock. Here, take a look at this clock.
Wani & Syaf: Okayy, sure Nik!

Wani: Wowww, quickly open the packaging, Syaf.
Syaf: Well, please take a look, hahaha.
Wani: Wait? But where is the manual? There will always be a manual.
Nik: Hm, this box does not provide a manual.
Wani: Hm, such a dull box.
Wani: The packaging looks terrible.
Asyifa: Yea, very bad.
Wani: Huuaaaaaa.
Nik: But even though the packaging is terrible, let's see how it looks inside.

Wani: Agreed! Let's take a look at it first. Just follow on what Nik said.
Syaf, Wani and Asyifa: Hahaha okay.
Wani: In my opinion, the design of the alarm clock seems a bit classic. Before we proceed, what is the function of this clock?
Nik: Typically, the function of the alarm clock is to show the time. Let's insert the battery so we would know if it's good or not.

Syaf: Okay, let's insert the batteries first.
Nik: For this clock, we need Tripple A batteries.
Wani: I see, it's a lot of battery that we need.
Nik: Yes. Hahaha.
Wani, Syaf and Asyifa: Wowww!!
Syaf: It sounds too cute.
Wani: Feeling like a child, hahaha.

HiTECH

Nik: By the way, is the sound of this alarm boring or not?
Asyifa: For me, it's quite dull.
Nik: I see.
Asyifa: Yes, I don't like it too.
Syaf: It's okay for boys but not for us. It doesn't fit us.
Asyifa: Yes, it's out of my interest. The clock looks classic enough, but when it started to sound, it doesn't sound very pleasant.

Wani: What is the size of this alarm clock? I mean the measurements?
Nik: Okay, so for the measurements, the tall and the length is 157mm. While the width is 87mm.
Syaf: Oh. It's very compact and suitable to bring it anywhere.
Wani: Yes, because the size is not big but not too small.

Shaf: But why is the screen on the packaging seems a bit different than the actual alarm clock?

Asyifa: I know, right! How could this be? Oh my god, what a fake hope!
Syaf, Wani, Asyifa & Nik: Hahaha!

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KAD 114 4C

ROLEPLAY

LOGAN

Nik: Okay, in terms of color, what do you think? From your point of view? Does it fit the design?
Wani: It looks gloomy and effortless.
Shaf: Black!! It looks unattractive because of the color. It should be brighter, so it will look more beautiful.

Asyifa: So the color is black. If it's in the dark, how the clock glow? Wani: Hmm, that's right. How will it look like? Nik: Okay, let me explain. If we place it on a flat surface, for example, on a table, right? When we want to see it glow in the dark, we could just clap like this.

Nik: See, when I clap, it lights up! Apart from that, this watch is also sensitive. Even if I place it like this, it can glow.
Wani: Oh, could it waste the battery?
Nik: It's a waste. If possible, leave the power button on the back in off mode. When we want to set the alarm, just turn it on. Because even if we are off, the clock digit will still appear on the screen.

Wani: Then look at this watch. Provided with day, hour, date. So easy for us to know the time and date.

Nik: Right, if it's a standard clock, it only shows the digit of the hour, minute and second.
Shaf: Yes, I think this is good than enough.
Nik: For more details, this clock can show the hours, minutes, months, weeks and calendars for 100 years. More importantly, it can show temperature readings.

ROLEPLAY

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LOGAN

Nik: So, for this watch material, it is made of ABS plastic. It also has a high probability of breaking.
Shaf: Is it expensive?
Nik: You can get this for RM19.00 only. It is also worth buying.
Wani & Syaf: Wow, it is standard with the price and size of the clock. The design is also lightweight.
Wani: Okay, not bad.

Asyifa: Hmm, how to set this alarm?
Nik: As we don't have the manual from the beginning when purchasing it, I tried to explore for myself how to use it and set my alarm that day.
Asyifa: Oh, so how do you set this alarm?

Nik: So this is how to set the alarm. There are buttons to set up at the back. To set it, press the set button for three times or more. Press it in about 5 seconds or more so that the clock will show up the number digit of the hour. So from there, we just need to press the button up and down to adjust the hour. Same for minutes. When you have set the clock, press the set button again to change it for a minute and lastly select it.
Wani & all: Okay, we finally understand.

Wani: Hm this alarm sounds loud?
Nik: This clock is not very loud but can be heard for one room.
Wani: And what kind of sound is that? Isn't other music?
Nik: Only this music, and can not play different songs.
Shaf: I see, okay, I understand.

Shaf: Is it static like this? Because there is a watch that has an ear to make it more interesting.
Nik: Yes, the design is just simple like this. Maybe because the designer wants to make it to look simpler or not complicated?

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Figure 3.3: Role-play between the researcher and the respondents.

CONTENT ANALYSIS
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LOGAN
INDICATOR
TRANSCRIBE
FORM
Wani: The packaging looks terrible.
Asyifa: Yea, very bad.
Wani: In my opinion, the design of the alarm clock seems a bit classic.
Asyifa: For me, it's quite dull.
Nik: I see.
Asyifa: Yes, I don't like it too.
Syaf: It's okay for boys but not for us. It doesn't fit us.
Asyifa: Yes, it's out of my interest.
Syaf: Oh. It's very compact and suitable to bring it anywhere.
Wani: Yes, because the size is not big but not too small.
Shaf: But why is the screen on the packaging seems a bit different than the actual alarm clock?
Asyifa: Yes, it's out of my interest. The clock looks classic enough.
Wani: What is the size of this alarm clock? I mean the measurements?
Nik: Okay, so for the measurements, the tall and the length is 157mm. While the width is 87mm.
Wani & Syaf: Wow, it is standard with the price and size of the clock. The design is also lightweight.
Wani: Okay, not bad.
INDICATOR
TRANSCRIBE
FORM
Shaf: Is it static like this? Because there is a watch that has an ear to make it more interesting.
Nik: Yes, the design is just simple like this. Maybe because the designer wants to make it to look simpler or not complicated?
Asyifa: But when we look at it from the side view it does looks like a speaker.
Wani: Finally, someone thinks the same as me.
Nik: Yes, it is. Maybe the designer took the speaker's inspiration when he wanted to design this clock.
Shaf: I'm not very interested in this kind of design. As for my opinion, you can add something on your design, such as little pattern to match the body part of this watch to highlight it. Or you can add floral patterns.
Wani: That's right Wani. It seems too simple, right.
Asyifa: If it's for men, maybe it's okay, but if it's for women, I don't think so.
Nik: Next, if in terms of ergonomic right. When you hold it, do you feel comfortable?
Asyifa: It's fine because it fits with my big hand to hold.
Wani: Hmm okay because it's easy to grab, like holding a wallet ..
Shaf: Hm okay because the button is not very close, so it makes it easier for us to set the alarm.
Wani: Yes, true. There is space between one button to another button.
Shaf: It also does not weigh much.
Bhaf: In terms of design, it is too simple. And for students who want to buy this watch for their needs every morning is very recommended.
HiTECH

CONTENT ANALYSIS

NIK NUR ANEESA BINTI ZAMZURRI
2018698326
KAD 114 4C

LOGAN

INDICATOR	TRANSCRIBE
FUNCTION	Nik: Typically, the function of the alarm clock is to show the time. Let's insert the battery so we would know if it's good or not. Syaf: Okay, let's insert the batteries first. Nik: For this clock, we need Tripple A batteries. Nik: By the way, is the sound of this alarm boring or not? Asyifa: For me, it's quite boring. Nik: I see. Asyifa: Yes, I don't like it too. Syaf: It's okay for boys but not for us. It doesn't fit us. Asyifa: Yes, it's out of my interest. The clock looks classic enough, but when it started to sound, it doesn't sound very pleasant. Wani: Hmm, that's right. How will it look like? Nik: Okay, let me explain. If we place it on a flat surface, for example, on a table, right? When we want to see it glow in the dark, we could just clap like this. Wani: Then look at this watch. Provided with day, hour, date. So easy for us to know the time and date. Nik: Right, if it's a standard clock, it only shows the digit of the hour, minute and second. Shaf: Yes, I think this is good than enough. Nik: For more details, this clock can show the hours, minutes, months, weeks and calendars for 100 years. More importantly, it can show temperature readings. Nik: See, when I clap, it lights up! Apart from that, this watch is also sensitive. Even if I place it like this, it can glow. Wani: Oh, could it waste the battery? Nik: It's a waste. If possible, leave the power button on the back in off mode. When we want to set the alarm, just turn it on. Because even if we are off, the clock digit will still appear on the screen.

INDICATOR	TRANSCRIBE
FUNCTION	Nik: So this is how to set the alarm. There are buttons to set up at the back. To set it, press the set button for three times or more. Press it in about 5 seconds or more so that the clock will show up the number digit of the hour. So from there, we just need to press the button up and down to adjust the hour. Same for minutes. When you have set the clock, press the set button again to change it for a minute and lastly select it. Wani & all: Okay, we finally understand. Wani: Hm this alarm sounds loud? Nik: This clock is not very loud but can be heard for one room. Wani: And what kind of sound is that? Isn't other music? Nik: Only this music, and can not play different songs. Asyifa: First of all, I'm not too fond of the sound of the alarm issued by this clock because I am the type who has difficulty in waking up from sleep. If possible, I want a song that when heard, is very annoying. I want the sound that makes us easier to wake up, if it sounds like this, it's tough to get up.
MATERIAL	Asyifa: Sure, it will not be slippery if placed on a surface like this? Look when we touch on the surface, it feels slippery. Nik: So in your opinion, what needs to be added to the surface? Shaf: Maybe you can add a liner underneath like a material made of rubber. So it is not easy to move and fall. Wani: Yes, to reduce friction. Nik: So, for this watch material, it is made of ABS plastic. It also has a high probability of breaking.

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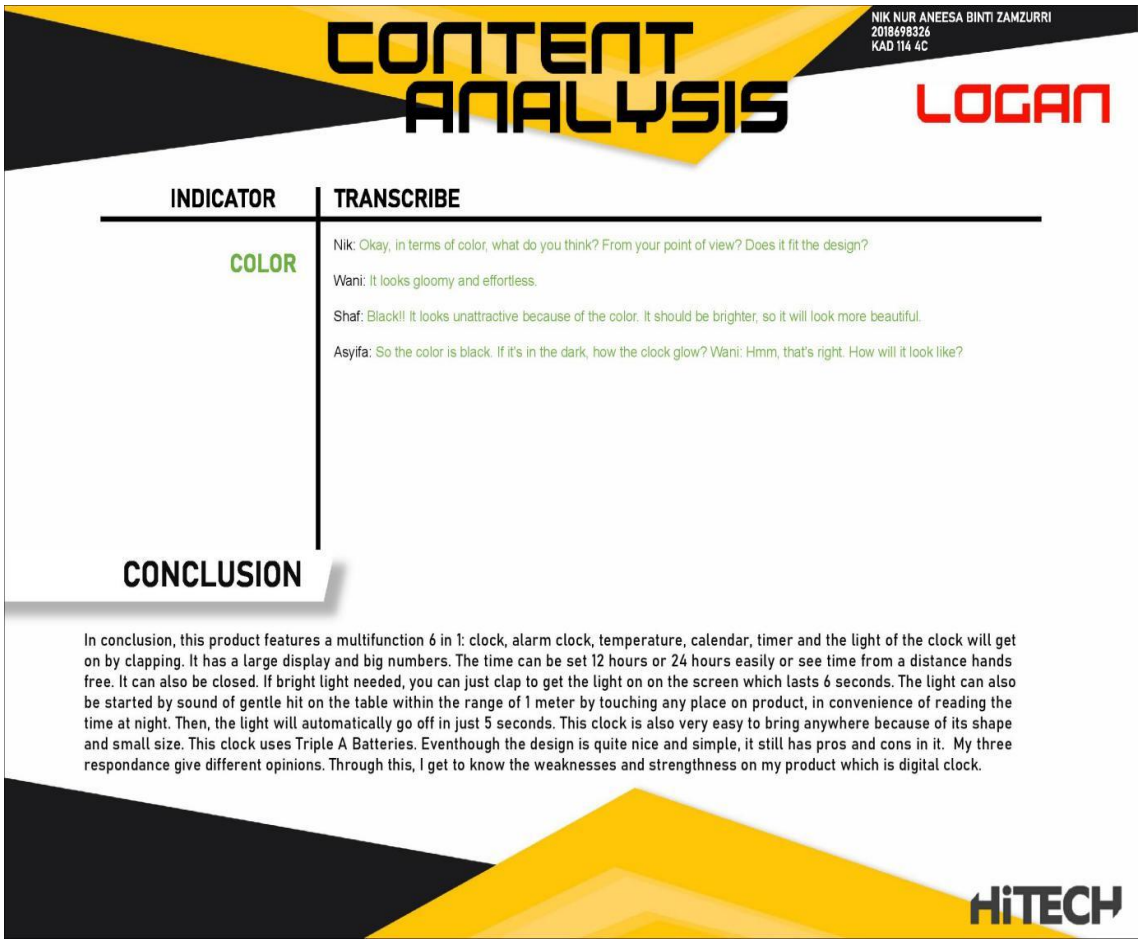


Figure 3.4: Content Analysis

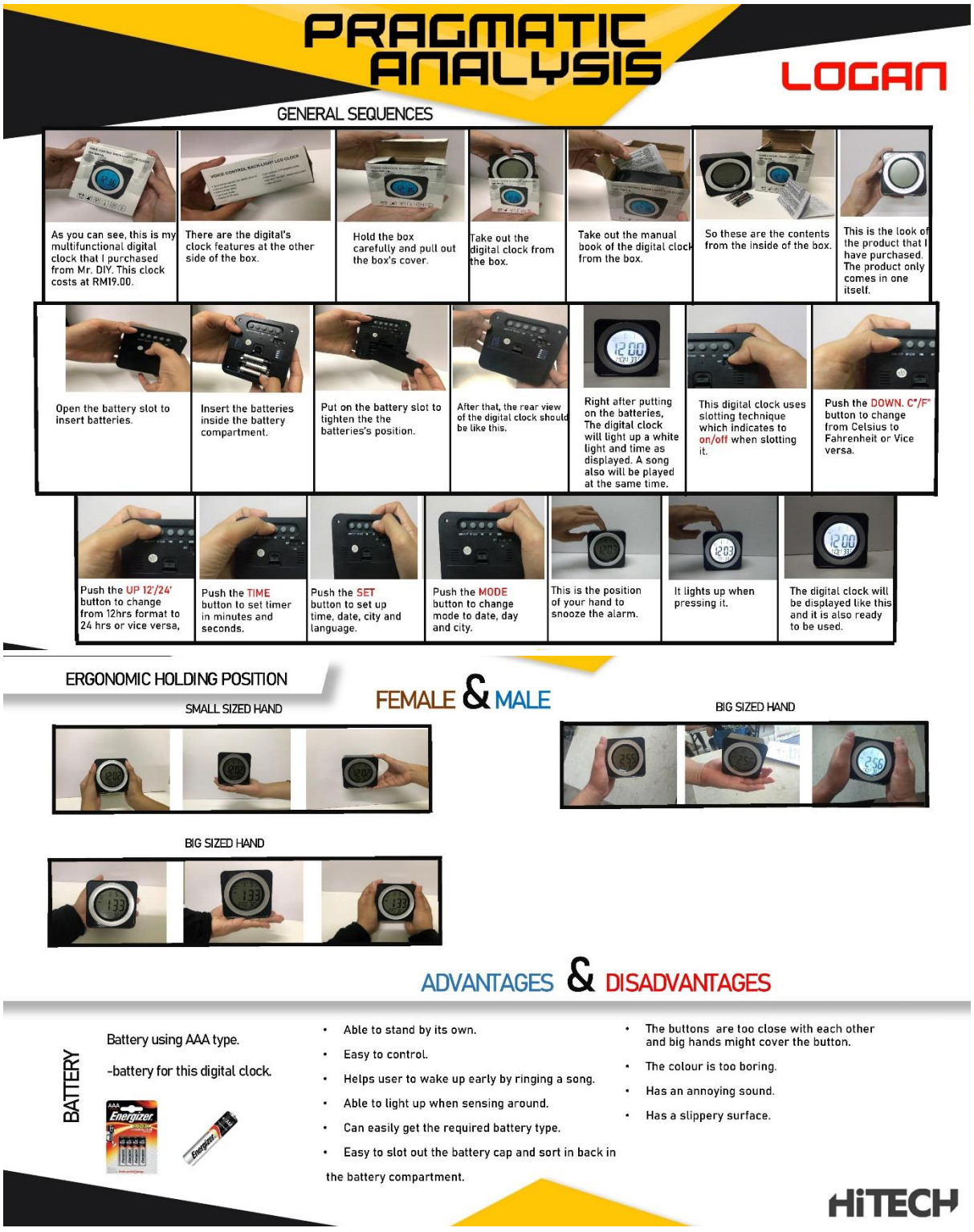


Figure 3.5: Pragmatic Analysis

Figure 3.6: Semantic Analysis

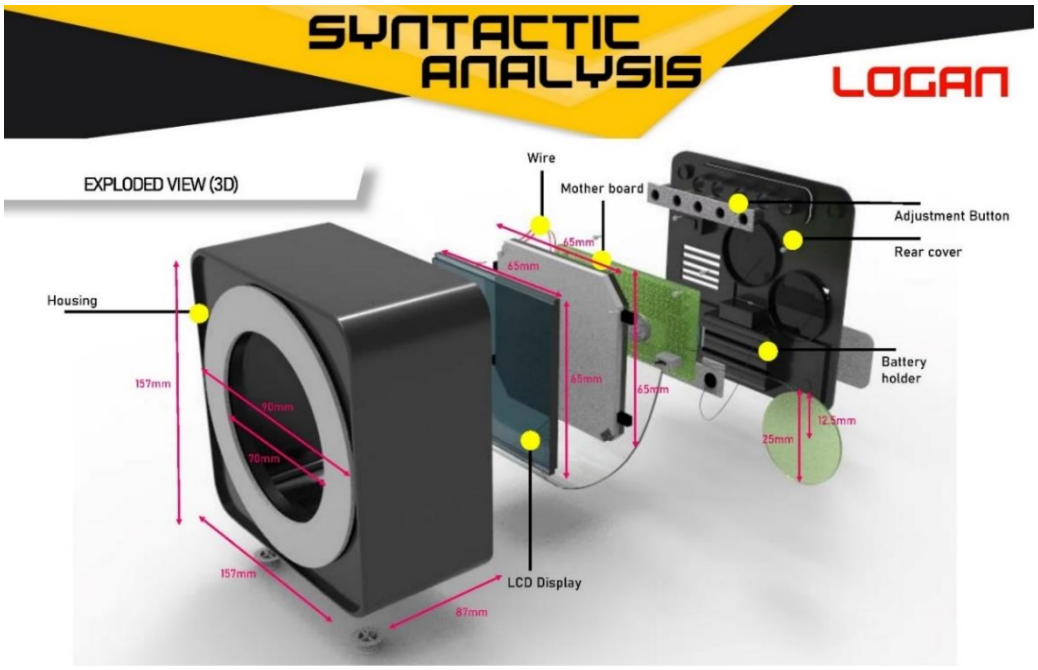
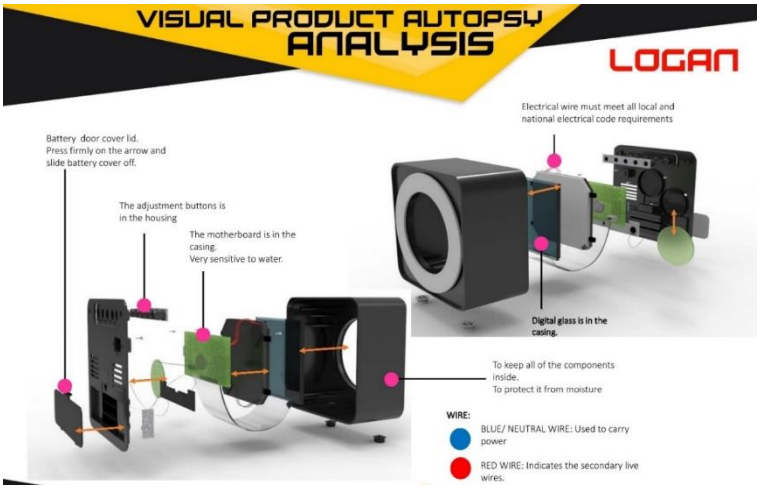


Figure 3.7: Syntactic Analysis

Figure 3.8: Visual Product Autopsy Analysis



NUM.	PARTS	IDENTIFICATION	FUNCTION	TOLERANCE	NOTES
1.	Battery door cover lid.	• Movable part and single component.	• Covering the battery, protects it from moisture, which can cause a shock. • Ensuring a good connection.		• Can be redesigned.
2.	Adjustment button	• Movable part and single component.	• To set up the digital clock.		• Can be redesigned.
3.	Battery holder.	• Movable part and single component.	• To store the batteries inside.		• Can't be re-designed.
4.	Rear cover	• Movable part and single component.	• To cover all of the components inside.		• Can be redesigned.
5.	Battery cap	• Movable part and single component. • Can be removed from battery compartment.	• To reduce the need for equalization of batteries.		• Can be redesigned.
6.	Circuit board	• Movable part and single component.	• To provide the electrical connection of electronic components.	• Internal jointing with main motherboard.	• Can't be redesigned.
7.	Mother board	• Combination and build in part which attach with switch button.	• Holds together many of the crucial components of digital clock.	• Internal jointing with circuit board.	• Can't be redesigned.
8.	Plastic sheet	• Movable part and single component.	• A protective layer for the LCD display.		• Can be resized depends on the adjustment button.
9.	Screen plate	• Movable part and single component.	• To provide support to the LCD display.		• Can't be redesigned.
10.	LCD display	• Movable part and single component.	• To produce a visible image. • To present words, digits and seven-segment displays.		• Can't be redesigned.
11.	Light and snooze button	• Movable part and single component.	• To snooze or turn off the alarm. • To light up the digital clock at night.		• Can be redesigned.
12.	Housing	• Movable part and single component.	• To keep all of the components inside. • To protect it from moisture.	• Internal jointing with motherboard.	• Can be redesigned.
13.	Stainless steel crew 3mm	• Movable part and single component.	• Used to hold two materials together tightly and efficiently.		• Can be resized
14.	Stainless steel crew 7mm	• Movable part and single component.	• Used to hold two materials together tightly and efficiently.		• Can be resized

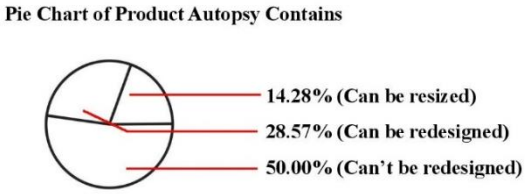


Figure 3.9: Observation Analysis on Product Autopsy Contains

Figure 3.10: Formal Aesthetic Design Analysis

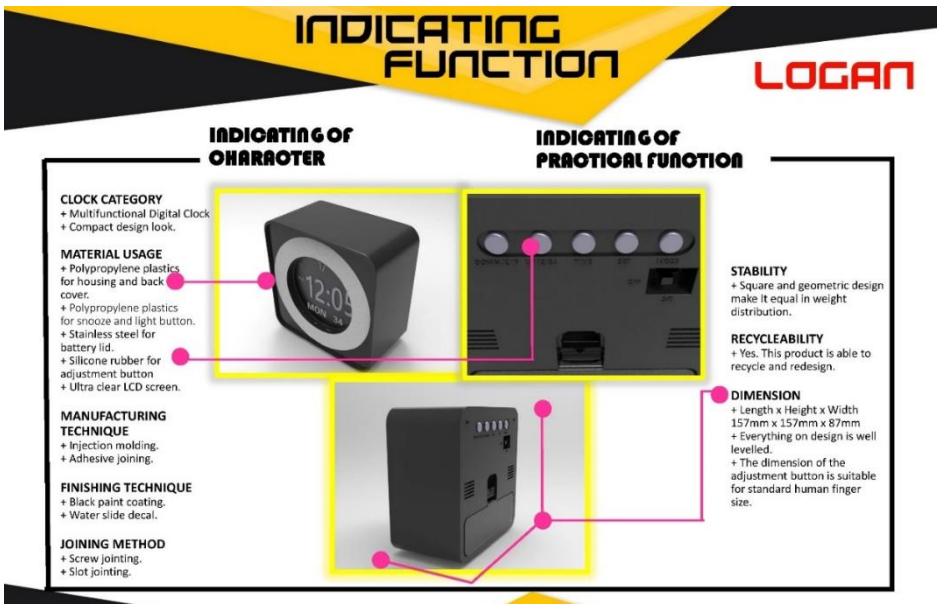
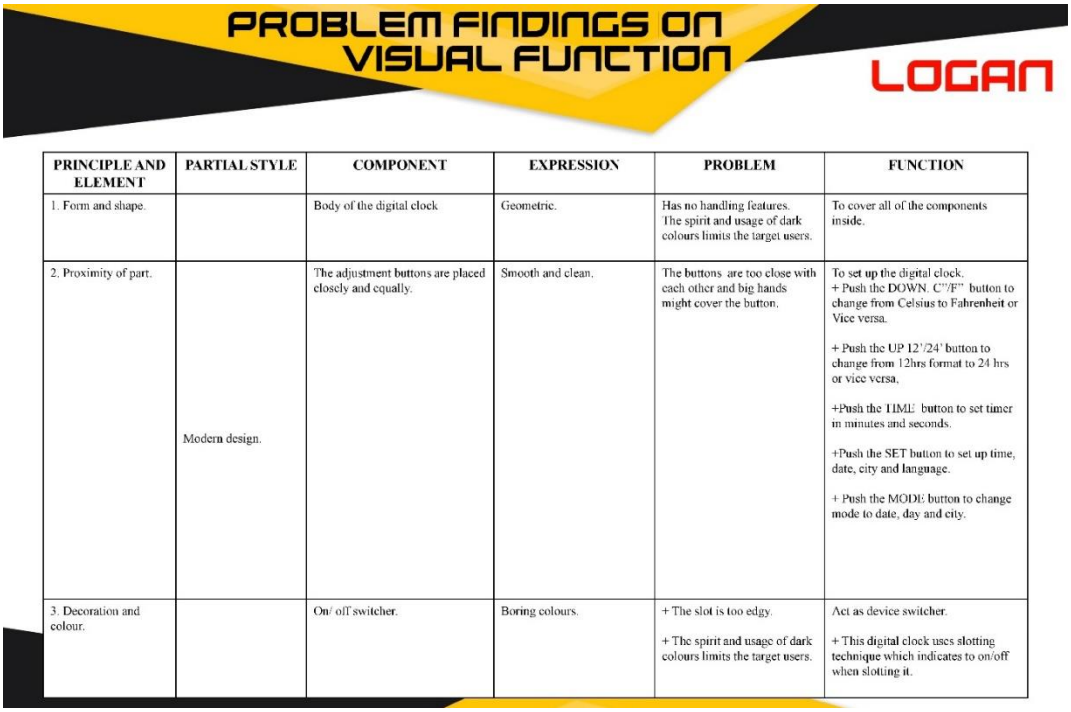


Figure 3.11: Indicating Function Analysis

Figure 3.12: Product Features and Function Analysis



PRINCIPLE AND ELEMENT	PARTIAL STYLE	COMPONENT	EXPRESSION	PROBLEM	FUNCTION
1. Form and shape.		Body of the digital clock	Geometric.	Has no handling features. The spirit and usage of dark colours limits the target users.	To cover all of the components inside.
2. Proximity of part.	Modern design.	The adjustment buttons are placed closely and equally.	Smooth and clean.	The buttons are too close with each other and big hands might cover the button.	To set up the digital clock. + Push the DOWN. C°/F° button to change from Celsius to Fahrenheit or Vice versa. + Push the UP 12°/24° button to change from 12hrs format to 24 hrs or vice versa. +Push the TIME button to set timer in minutes and seconds. +Push the SET button to set up time, date, city and language. + Push the MODE button to change mode to date, day and city.
3. Decoration and colour.		On/ off switcher.	Boring colours.	+ The slot is too edgy. + The spirit and usage of dark colours limits the target users.	Act as device switcher. + This digital clock uses slotting technique which indicates to on/off when slotting it.

Figure 3.13: Problem Findings on Visual Function

Figure 3.14: Product Pricing

Figure 3.15: Product Benchmarking

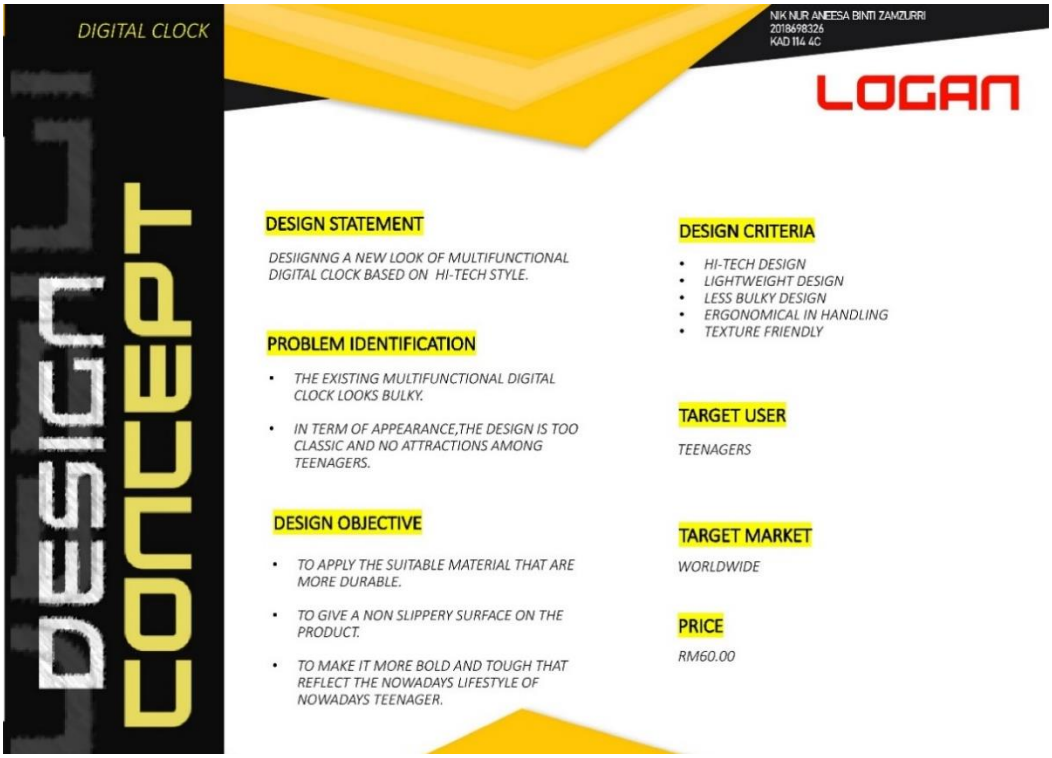


Figure 3.16: Design Concept

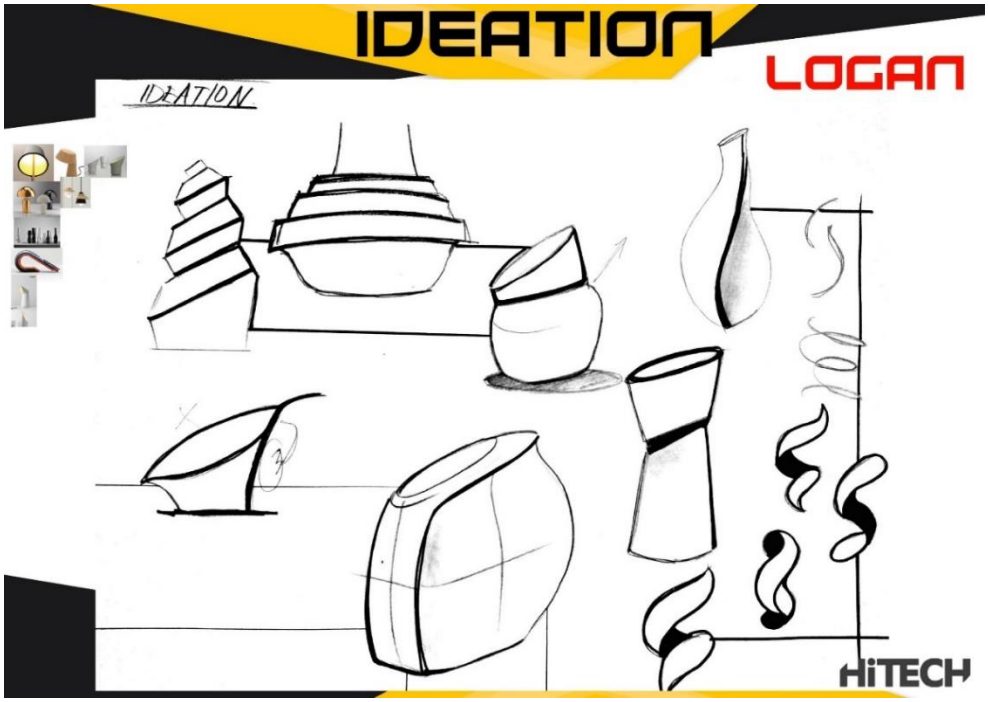


Figure 3.17: Ideation

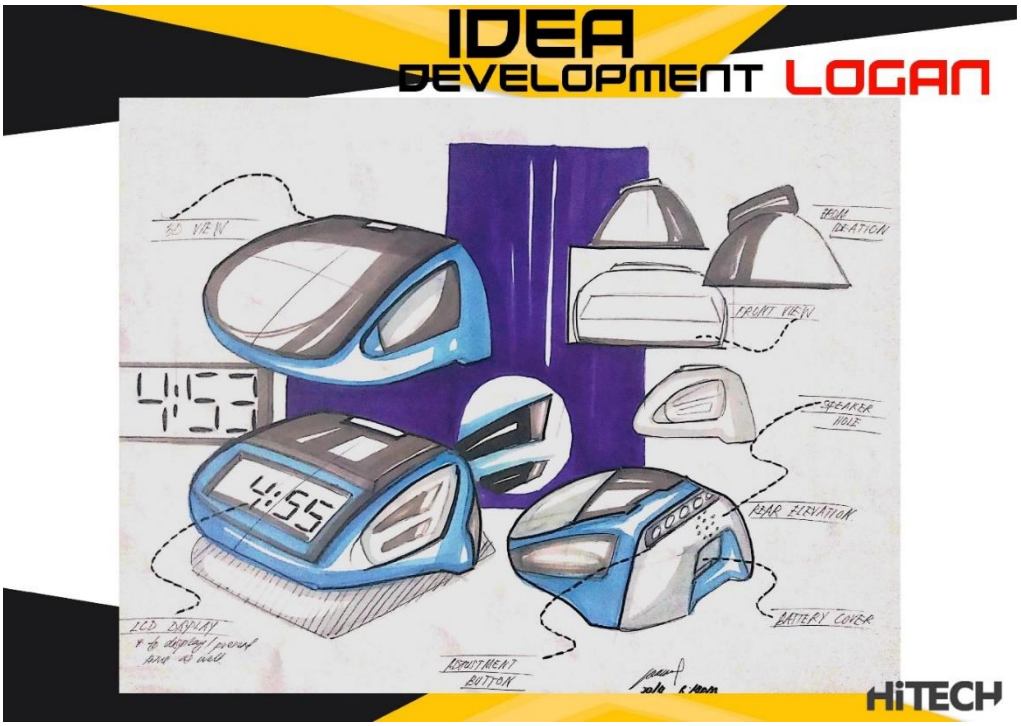


Figure 3.18: Idea Development

Figure 3.19: Design Development I & II

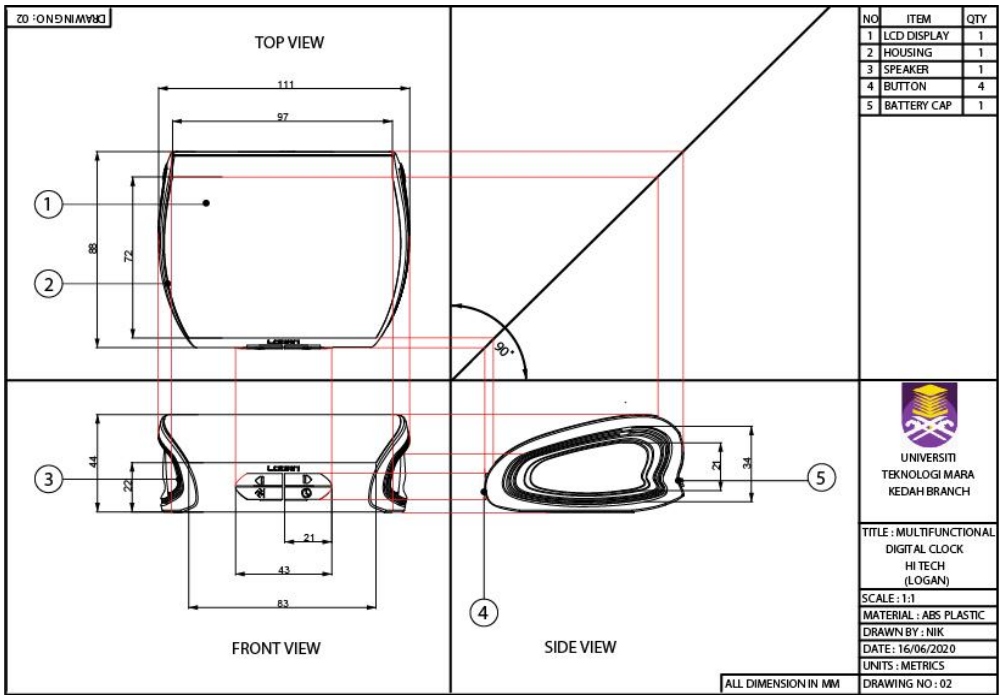
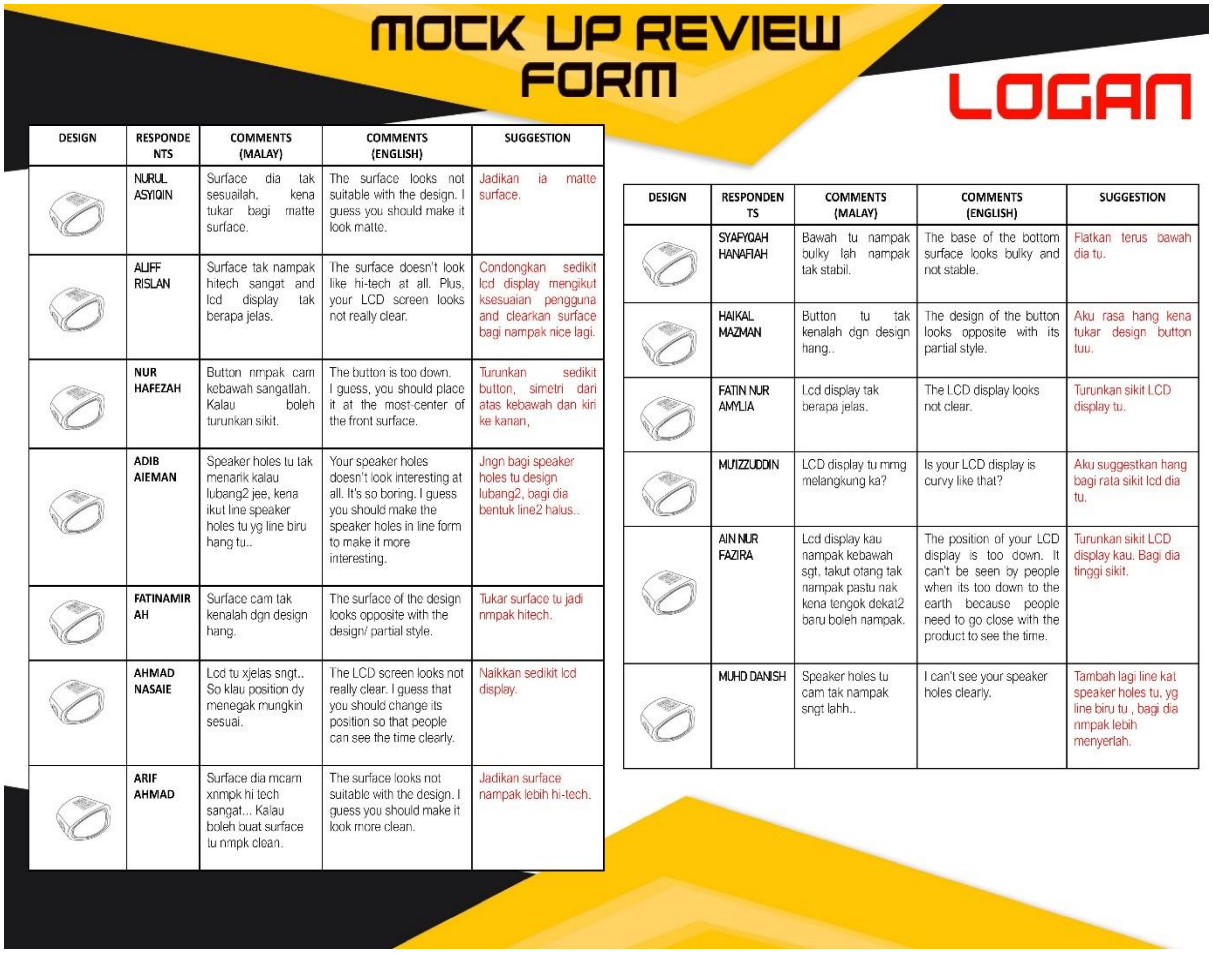


Figure 3.20: Technical Drawing of Final Design

3.4 Mock-up Review is a process whereby the mock-up design is reviewed by peers' which not directly involved in designing the product but suitably experienced to give opinions and input on design whether on design, functionality or perceived quality to improve design of product.



MOCK UP REVIEW FORM

LOGAN

DESIGN	RESPONDENTS	COMMENTS (MALAY)	COMMENTS (ENGLISH)	SUGGESTION
	NURUL ASYIQIN	Surface dia tak sesuailah, kena tukar bagi matte surface.	The surface looks not suitable with the design. I guess you should make it look matte.	Jadikan ia matte surface.
	ALIFF RISLAN	Surface tak nampak hitech sangat and lcd display tak berapa jelas.	The surface doesn't look like hi-tech at all. Plus, your LCD screen looks not really clear.	Condongkan sedikit lcd display mengikut ksesuaian pengguna and clearkan surface bagi nampak nice lagi.
	NUR HAFEZAH	Button nmpak cam kebawah sangatlah. Kalau boleh turunkan sikit.	The button is too down. I guess, you should place it at the most-center of the front surface.	Turunkan sedikit button, simetri dari atas kebawah dan kiri ke kanan,
	ADIB AIEMAN	Speaker holes tu tak menarik kalau lubang2 jee, kena ikut line speaker holes tu yg line biru hang tu..	Your speaker holes doesn't look interesting at all. It's so boring. I guess you should make the speaker holes in line form to make it more interesting.	Jngn bagi speaker holes tu design lubang2, bagi dia bentuk line2 halus..
	FATINAMIRAH	Surface cam tak kenalah dgn design hang.	The surface of the design looks opposite with the design/ partial style.	Tukar surface tu jadi nmpak hitech.
	AHMAD NASAIE	Lcd tu xjelas sngt.. So klau position dy menegak mungkin sesuai.	The LCD screen looks not really clear. I guess that you should change its position so that people can see the time clearly.	Naikkan sedikit lcd display.
	ARIF AHMAD	Surface dia mcam xnmpk hi tech sangat... Kalau boleh buat surface tu nmpk clean.	The surface looks not suitable with the design. I guess you should make it look more clean.	Jadikan surface nampak lebih hi-tech.

DESIGN	RESPONDENTS	COMMENTS (MALAY)	COMMENTS (ENGLISH)	SUGGESTION
	SYAFYQAH HANAFIAH	Bawah tu nampak bulky lah nampak tak stabil.	The base of the bottom surface looks bulky and not stable.	Flatkan terus bawah dia tu.
	HAIKAL MAZMAN	Button tu tak kenalah dgn design hang..	The design of the button looks opposite with its partial style.	Aku rasa hang kena tukar design button tuu.
	FATIN NUR AMYLIA	Lcd display tak berapa jelas.	The LCD display looks not clear.	Turunkan sikit LCD display tu.
	MUIZZUDDIN	LCD display tu mmg melangkung ka?	Is your LCD display is curvy like that?	Aku suggestkan hang bagi rata sikit lcd dia tu.
	AIN NUR FAZIRA	Lcd display kau nampak kebawah sgt, takut otang tak nampak pastu nak kena tengok dekat2 baru boleh nampak.	The position of your LCD display is too down. It can't be seen by people when its too down to the earth because people need to go close with the product to see the time.	Turunkan sikit LCD display kau. Bagi dia tinggi sikit.
	MUHD DANISH	Speaker holes tu cam tak nampak sngt lahh..	I can't see your speaker holes clearly.	Tambah lagi line kat speaker holes tu, yg line biru tu , bagi dia nmpak lebih menyerlah.

Figure 3.21: Mock-Up Review Form

Figure 3.22: Final Design

CONCLUSION

As a conclusion for this study, the existing multi-functional digital clock features all the expected features such as clock, snooze, customized alarm settings, temperature, timer, calendar and a loud alarm clock but yet the design doesn't look good enough as it looks

bulky. While in term of appearance, the design is too classic and has lack of attractions among teenagers because they are expecting for well design. The researcher designs this visual to make the process of manufacturing easier in using SLS technology. Due to this, designing a new multi-functional digital clock is one of the solution to fix the problem. The benefits that people can gain by using this multi-functional digital clock is people with small hands can hold the product properly. Plus, people may choose which color they want as it is designed with three colour combination from black, merlot and alloy orange so that it suits their room perfectly. Last but not least, based on the researcher's understanding, reverse engineering is something which is going from tail to head. It is a study of a product on how it is manufactured, finding out manufacturing procedure by that thing which we need to break it down to its parts to figure how it works as a whole.

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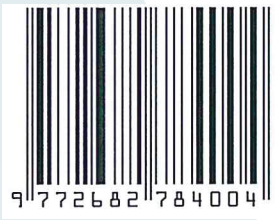

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