Comparison of Data Before and After Reverse Engineering on PCB Channel

Final Project Proposal

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Statement of Authenticity of Final Project

I, the undersigned, declare that the contents of part or all of my Final Project entitled “Reverse Engineering PCB Channel from MC3 BIT Machine” is the result of my own work, completed without using unauthorized materials, and is not the work of other parties that I recognize as my own work. All references quoted or referredto have been written in full in the bibliography. If it turns out that my statement is not true, I am willing to accept sanctions according to applicable regulations.

Batam, 03 Juli 2023

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Validity sheet

The Final Project was prepared to fulfil one of the requirements to obtain the degree of
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Comparison of data Before and After Reverse engineering on PCB Channel

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***Abstract*— The BIT (Build In Test) process is the process of checking the function of household electrical products such as coffee brewer machines, this test uses a machine called MC3 BIT. Inside the MC3 BIT machine there are various kinds of PCBs, namely PCB Channel, PCB data filter, PCB Volt filter, 120V travo, and so on. And the MC3 BIT machine also needs a PCB Channel so that the functions of the product can be read on the PCB Channel.**

To perform reverse engineering, PCB Channel needs to perform 2 methods, namely disassembly and reassembly. This method is not only used to engineer PCBs, but also can reverse engineer software, machinery, aircraft, architectural structures, PCBs and other products that are deconstructed to extract design information from them.

However, re-engineering a channel PCB will take a very long time, because theauthor needs to research more deeply about the value of the components in the channel PCB and also research the paths on the channel PCB. for this reason, analysis methods such as Disassembly and Reassembly are needed, and continued by making a schematic. for the test, the author needs 1 day for 1 Channel PCB.

Keyword:. Checking, Test, Reassembly, research, methods

I. INTRODUCTION

A. Background

PT Simatelex Manufacturing is a company engaged in manufacturing household electrical appliances such as coffee makers, pizza makers, rice cookers, and others. In the process of making household electrical appliances products, there are stages of the process, one of which is the Build In Test (BIT). Namely the process of testing the function of the product. This test uses a machine called MC3 BIT. Inside the MC3 BIT machine has various PCBs, namely PCB Channel, PCB data filter, PCB Volt filter, 120V travo[1], and so on. The PCB that will be remade is the PCB Channel schematic, because the

PCB has no schematic and also often experiences a lot of damage among other PCBs on the MC3 BIT machine, one of the damages is the display display on the MC3 BIT machine which is not read for voltage (V) andcurrent (A) on the PCB.

Because there is no schematic from the company, therefore the author will make a project title is *comparison of Data Before and After Reverse Engineering of PCB Channel.* Because previously the PCB Channel did not have a schematic, becausethe PCB schematic was confidential by thecompany PT Simatelex from China, andthe company team in Batam could only order from the company in China. Therefore, the author's goal is to reverse engineer the PCB Channel schematic so that it can be made by a local company.

PCB Channel

PCB Channel serves to convert AC voltage (alternating current) into DC voltage (direct current). In addition, PCB power supply has features such as protection against overvoltage, protection against overcurrent, and voltage division according to application needs. PT Simatelex Manufactory Batam Usually used for product testing machines such as wet-test, BIT (Build in test), and Voltbar monitoring. The voltage issued by the output of the PCB Channel is a maximum of 120V-126V, if the product testing voltage exceeds or is less than the specified number, then the item cannot be tested, because if it is less or exceeds the specified limit it can be considered abnormal on the machine, the solution to reduce abnormal things is monthly machine maintenance.

Figure 1. Picture of PCB Channel

II. METHOD

A. Designs

To achieve research results as expected, this research begins with a literature study which includes library data collection activities, reading and recording information related to this research. Followed by Process Disassembly

and Reassembly. After the process, then create a schematic for PCB Channel.

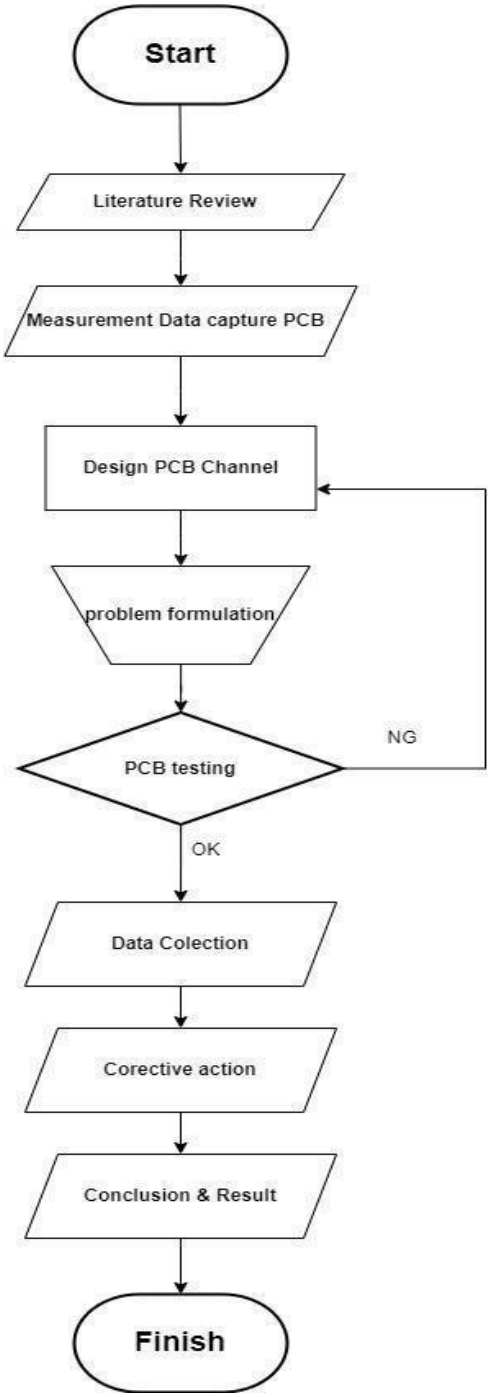

Figure 2. Flowchart

B. Tools and Materials

Disassembly

The Disassembly method is to release all components in the PCB which aims to determine the PCB circuit, length, height, width on the PCB, and the types of components in the PCB Channel. if the component value is not appropriate or the type of component is different, then the problem can be used as a solution whether it can be if the PCB component is replaced by the same component but uses a different type, different value and affordable price. According to F. Daywin, at this stage, disassembly is carried out on a benchmark disassembly machine which serves to identify and analyze each function of the product components. [2]

Reassembly

The Reassembly method is to install the components again which aims to find out the function of all components and circuits on the PCB whether they are *shortor and whetherthe* function on the PCB is functioning or not, as well as determining whether the components are suitable for use or not. Re-assembly broken objects from a large collection of randomly mixed fragment is a problem that often arises in archaeology.

C. Testing

In this study, Reverse Engineering is used to modify or redesign a new Channel PCB so that the channel PCB has a new schematic. However, it is alsoneeded in the testing stage if the Disassembly and Reassembly process stage has been completed, this test is carried out at PT Simatelex Manufacturing Batam:

Testing Techniques

The technique carried out in this test is by direct t esting. Where the test checks voltage, current, and wattage,by knowing the check is as follows:

1. Provide voltage and current for PCB Channel from 120V travo by installinginside MC3 BIT.
2. Start the engine and Check the MC3 BIT display whether voltage, current, and wattage values appear on the display or not.
3. If there is no volt value and volt out of limit value, it needs to be analyzed like a machine connection and checked using a multimeter.

Channel PCB testing also has a limit standard at the specified volts, the result must not exceed 1.0V and this test does not use a 120V travo, the reason is that if the volt value on the PCB Channel is out of limit and forced to use a 120V travo will be damaged on the PCB Channel[1].

Testing Objective

The test aims to ensure the PCB Channel value is according to the standard, and if so, then continue by doing the method on the flow chart. The target PCB to be produced is 50 units and the test sample will be 10 PCB units.

Testing Tools

The testing equipment used in this final project is a 120V Multimeter and Travo, to see the volt standard on the PCB Channel and the tool used for data input is a fishbone diagram. The rootcause of the problem in the title is implemented using the fishbone method, as a way to find out which one is close to the root of the problem. the following is a fishbone diagram:

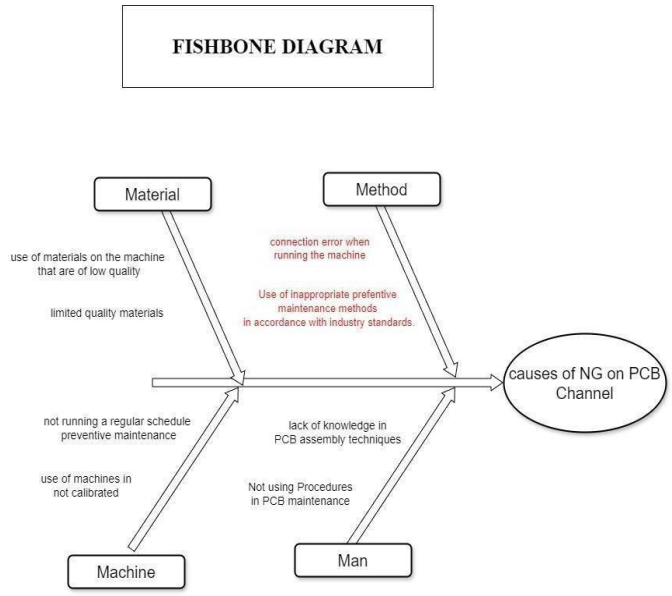

Figure 8. Fishbone Diagram

as seen in the fishbone diagram image, the cause of the problem that is approaching the PCB Channel damage is from the method. because when the PCB Channel is short, the PCB cannot read the voltage given by the 120V travo, but I will explain one by one about my fishbone results.

From the fishbone, the root of the problem is known. errors that often occur are methods, due to the use of improper methods during machine maintenance, machine repair and others. and seen from the actual it is quite often the case that using methods is not in accordance with company standards.

I. RESULTS AND DISCUSSION

A. Research Results Data

Design for PCB channel

for designs made using altium, here is a schematic of the PCB channel design:

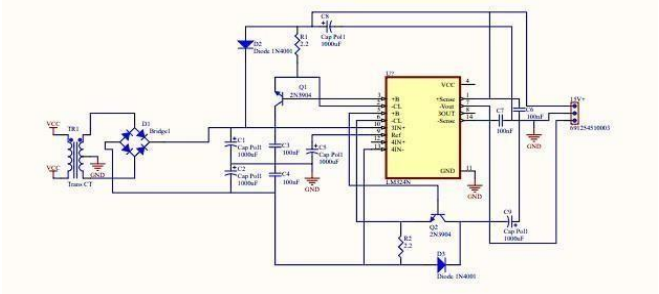

Figure 3. schematic for reverse engineering PCB Channel

From Figure 3 of the Channel PCB schematic, the IC component that I use is LM324N which is used by the Channel PCB. and the design in pictures 4 and 5 was made to the size of the PCB Channel, namely 9.4 mm long and 5.1 mmwide, and for picture 6 because it used a 3D concept to add illustrations before the PCB Channel was made. for image 4 of the top layer design, image 5 of the bottom layer and image 6 of the 3D design as follows:

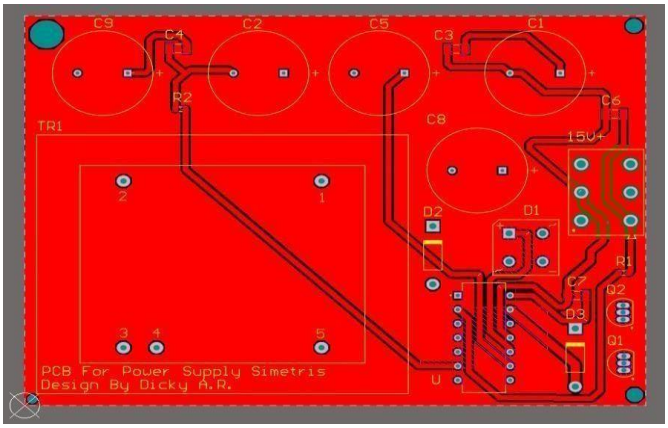

Figure 4. PCB Channel Design Top Layer

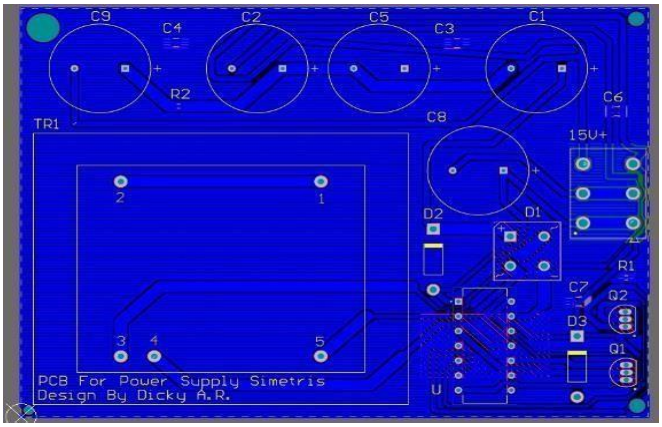

Figure 5.PCB Channel Design Bottom Layer

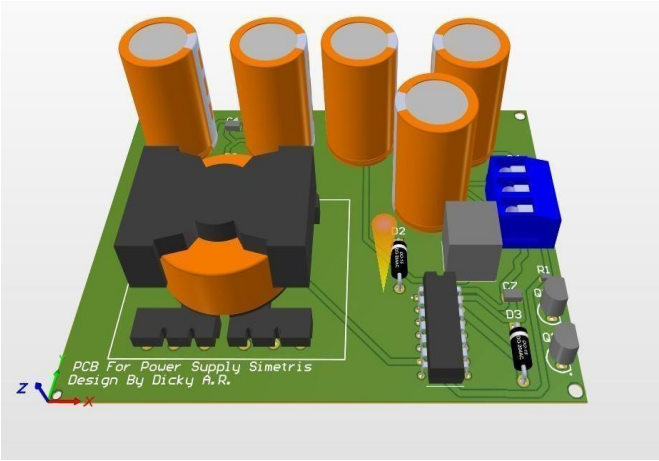

Figure 6. 3D PCB Channel Design

for the image above is the result of the design of the top layer for Figure 4, and the bottom layer in Figure 5 and the layer images for Figures 4 and 5 are the result of the schematic

circuit from Figure 3, while for figure 6 is the engineering for the 3D image for the finished result.

The method uses disassembly and reassembly. Its purpose is to find out the circuit on the PCB, the size of the PCB components, and the pad on the PCB.

Result of PCB checking

When testing the PCB Channel on the MC3 BIT machine, there is a comparison of the test before the design improvement results and after the improvement. The following is the PCB Channel Testing Checksheet data record before improvement:

Day	PCB 120			
	1	2	3	4
1	OK (120.9 v)	NG (000.0)	NG (000.0)	NG (000.0)
2	OK (120.8 v)	OK (120.3 V)	OK (120.3 V)	OK (121.4V)
3	NG (000.0)	OK (120.0 V)	OK (122.3 V)	OK (120.1V)
4	OK (120.4V)	OK (120.2)	OK (120.5V)	OK (120.0V)
5	OK (120.1V)	OK (123.5V)	OK(122.3V)	OK(120.4V)
6	OK (124.0V)	NG (000.0)	NG (000.0)	NG (000.0)
7	NG	OK(122.3V)	NG (000.0)	NG (000.0)
8	OK (120.5V)	OK(122.3V)	OK (121.4V)	OK (120.8 v)
9	OK(122.3V)	OK (123.5V)	OK(122.3V)	OK (120.1V)
10	NG (000.0)	NG (000.0)	NG (000.0)	NG (000.0)
11	OK (120.5V)	OK (120.1V)	NG (000.0)	OK (120.0 V)
12	OK (120.7V)	OK (120.0 V)	OK (120.8 v)	OK (120.3 V)
13	OK (120.5V)	OK (123.5V)	OK (120.0 V)	OK (123.5V)
14	NG (000.0)	NG (000.0)	NG (000.0)	NG (000.0)
15	OK (120.0 V)	OK (120.0 V)	OK (120.1V)	OK (120.3 V)

Table 2. Result Testing PCB Channel Before Improvement

As can be seen from the test records in table 2, the results of data collection before the improvement of the PCB Channel were NG. data collection in table 2 is not yet known what causes the PCB Channel to die completely or what is called NG. then the author makes the possibility that happened why the PCB experienced NG.

The possibility that can cause NG is that the material used is not good, a short circuit occurs, the voltage from the transformer exceeds the capacity so that it also experiences a short, and the PCB Channel has a voltage leak. To confirm whether there is a reduction in NG or not, the author makes a concept by taking data for comparison between data before improvement and after improvement and is made in the formof a checkseet as in table 2 and table 3.

testing samples taken are 60 PCB Channel samples, because the PCB Channel is only available, namely 70 samples. the author collects data and is implemented using the checksheet method as shown in table 2 and table 3. As shown in Table 3 after repair, there is an impact that makes the PCB Channel OK. but there is only 1 NG.

Day	PCB 120			
	1	2	3	4
1	OK (120.9 v)	OK (120.3 V)	OK (122.3 V)	OK(120.4V)
2	OK (120.8 v)	OK (120.3 V)	OK (120.3 V)	OK (121.4V)
3	OK (121.4V)	OK (120.0 V)	OK (122.3 V)	OK (120.1V)
4	OK (120.4V)	OK (120.2)	OK (120.5V)	OK (120.0V)
5	OK (120.1V)	OK (123.5V)	OK(122.3V)	OK(120.4V)
6	OK (124.0V)	OK (120.0 V)	OK (120.0 V)	OK (121.4V)
7	OK (120.0 V)	OK(122.3V)	OK (120.5V)	OK (121.4V)
8	OK (120.5V)	OK(122.3V)	OK (121.4V)	OK (120.8 v)
9	OK(122.3V)	OK (123.5V)	OK(122.3V)	OK (120.1V)
10	OK (120.1V)	OK (123.5V)	OK (121.4V)	OK(122.3V)
11	OK (120.5V)	OK (120.1V)	NG (000.0)	OK (120.0 V)
12	OK (120.7V)	OK (120.0 V)	OK (120.8 v)	OK (120.3 V)
13	OK (120.5V)	OK (123.5V)	OK (120.0 V)	OK (123.5V)
14	OK (123.5V)	OK (123.7V)	OK (120.0 V)	OK (120.0 V)
15	OK (120.0 V)	OK (120.0 V)	OK (120.1V)	OK (120.3 V)

Table 3. Result testing PCB Channel After Improvement

as can also be seen in table 3 after improvement for PCB Channel, why is the NG still there and why there is only 1 NG in the PCB Channel test?. The only 1 NG in table 3 is due to a test error in installing the input connection of the transformer, which can be said to be a connection error. for that option this possibility also affects.

As can be seen in Figure 7, the cause is the NG results in Table 3, data after improvement. Connection errors impact the components on the PCB Channel which experience a short on the PCB Channel components. This damage could also be due to the use of low quality materials, but this is a small possibility because before testing the author checked first using a multimeter whether the materials and connectionswere OK or not, after that the PCB Channel test was carriedout in 1 day for 4 PCs.

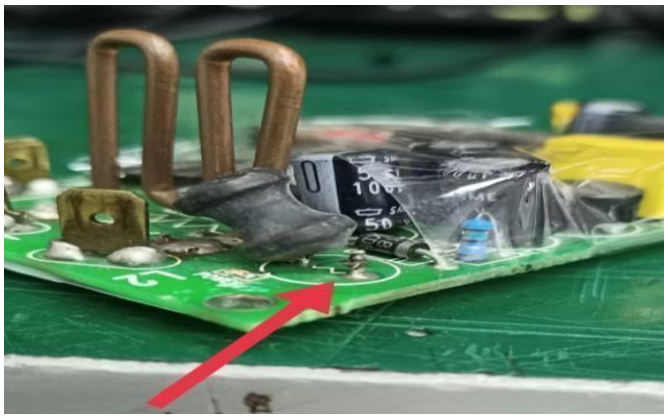

Figure 7. NG impact of connection error causes

and it can be said why the PCB channel often experiences damage, because connection errors often occur and also if it is not a connection error, it is possible that the PCB channel experiences a voltage leak and thus experiences a short.

NO	Name	Measurment Result
1	PCB	Length: 94.17 mm Width : 51.20 mm Thickness : 1.69 mm
2	Pitch Line	0,2 mm
3	Solder Thickness	SMD :0.05 – 0.38 mm Trough hole : 0.12 – 0.63 mm
4	Diode Count	SMD : 3 pcs Trough hole : 6 pcs Diode Bridge : 2 pcs
5	Resistor Count	SMD : 17 pcs Trough hole: 4 pcs
6	Capasitor Count	9 pcs
7	IC Count	6 pcs
8	LED	3 pcs
9	Value Voltage	120-125 V
10	Inductor	2 Pcs

Table 4. measurements for preparation of PCB Channel design

as can be seen in table 4 too, those are the measurement results for PCB Channel as final project planning for reverse engineering PCB Channel. The table also shows what components are used on the PCB Channel and calculated one by one.

PCB Channel testing procedures

for testing on PCB Channel using 120 V voltage Travo and using MC3 machine, continued with voltage measurement software. the test steps are:

1. prepare the machine, travo, and PCB checking software.
2. Attach the PCB Channel to the MC3 and then connect the machine to the computer port, so that the PCB voltage can be read into the software.
3. if it is well installed, then connect the MC3 machine to the travo and set the voltage to 120V
4. if the PCB is read in the software, then the PCB Channel is in good condition, but if it is not read, the PCB is in a NG (Not Good).

Ⅱ. DISCUSSION AND CONCLUSION

PCB Channel is a component that plays an important role in testing, because if the PCB Channel is damaged the product will not work. because the PCB Channel functions to receive input for AC voltage and provide voltage to the product to be tested. he conclusion of this final project is PCB, namely Printed Circuit Board, which is an electrical circuit that is on the board. There are also problems "why did the PCB Channel have a lot of damage before the improvement? and why when it has been improved there is still damage to the test?" and the conclusion is that there are often errors in the connection installation method when repairing the machine and preventive maintenance is not in accordance with the procedure. The appropriate corective action from the problem is to make the correct procedure method when installing the connection on the PCB Channel to the MC3 BIT machine and create a procedure for preventive maintenance.

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FORMULIR LOOGBOOK BIMBINGAN DAN PENGAJUAN SEMINAR PROPOSAL/SIDANG TUGAS AKHIR*

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NIM 3222101005
Pembimbing I : Nanta Fakih Prebianto, S.ST., M.Sc.
Judul : Reverse Engineering PCB Channel From MC3 BIT Machine

No	Hari/Tgl	Rincian Kegiatan	TTD Pembimbing I & II	
1	Kamis, 16 Mei 2024	Pembahasan jurnal, dan bab3		
2	Selasa, 28 Mei 2024	Pembahasan fishbone, serta mejelaskan hasil penyebab masalah pada penelitian		
3	Selasa, 25 Juni 2024	Pembahasan hasil jurnal, dan hasil data pada penelitian		
4	Jumat, 28 Juni 2024	Perbaikan jurnal pada fishbone, table data, persentase data		
5				
6				
7				
8				
9				
10				

Berdasarkan hasil bimbingan yang telah dilaksanakan selama_____bulan dan telah disetujui oleh dosen pembimbing, maka dengan ini saya mengajukan diri sebagai peserta Seminar Proposal /Sidang Tugas Akhir*.

Batam, 29 Juni 2024
Peserta
Dicky Aryayuda Saputra

Ttd pembimbing di hapus

NIM: 3222101005

*Hapus yang tidak perlu