9/5/2023

Rupom Saha c3268577

The University of Newcastle

Final Year Project

Draft

# Executive Summary

The use of modern Communication devices is integral to our lives. We have more technological devices in our time than the number of humans on earth. These devices are bound to get into a lot of accidental malfunctions. Electronics Repair is a very complex, time consuming and money consuming process. The process also requires special knowledge and experience to execute.

Finding ways to preserve communication is very essential to our modern way of life. Repairing and recycling is crucial in the preservation of that modern means of interaction. In a world with rising numbers of AI and automated technology, it is time for our devices to be fixed automatically.

Table of Contents

[Executive Summary 1](#_Toc161419557)

[1. Introduction 3](#_Toc161419558)

[2. Literature Review 4](#_Toc161419559)

[3. Methodology 6](#_Toc161419560)

[3.1 Fault Detection using Thermal Imaging 6](#_Toc161419561)

[4. Problem Statement 9](#_Toc161419562)

[5. Discussion 10](#_Toc161419563)

[6. Recommendation 11](#_Toc161419564)

[6.1 Future Research Path Recommendations 11](#_Toc161419565)

[7. Conclusion 12](#_Toc161419566)

[8. References 13](#_Toc161419567)

[9. Bibliography 14](#_Toc161419568)

[10. Appendix 17](#_Toc161419569)

# Introduction

In this project we will deal with the process of electronics repair and come to a modern innovative solution that involves automation. This project’s primary goal is to come up with a system that can identify hardware faults, analyse, and rectify.

The primary approach includes isolating a thought pattern of identifying damaged and unresponsive parts that will highlight the underlying problems with the device. There must be a prototype that can utilise the machine learning to produce a series of menial tasks that will save time in the long run.

The program would suggest different solutions to all kinds of problems, starting from repair to the mother board to recycling and selling of parts. The program and device can search the internet with possible solution to repairs and damage.

The required diagnostics will involve all with the help of repair knowledge integrated with machine learning which can solve most repair problems. For repairs on complicated circuits like motherboard and PCBs it will require thermal imaging to seek damages precisely.

# Literature Review

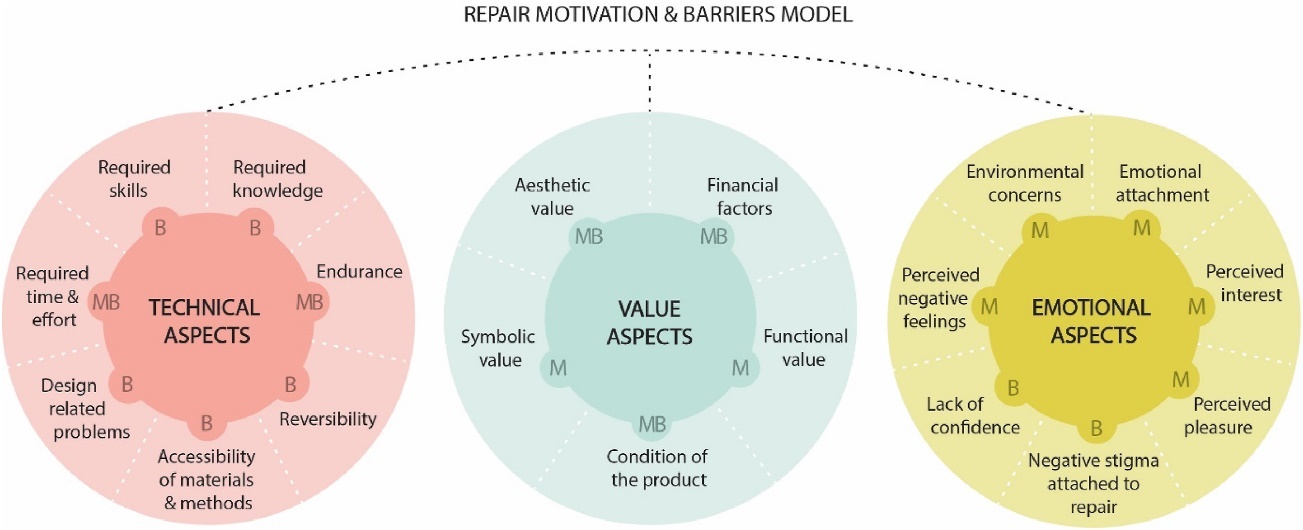


Figure 1: <https://ars-els-cdn-com.ezproxy.newcastle.edu.au/content/image/1-s2.0-S0959652620356900-gr8_lrg.jpg>

By identifying users’ motivations and the barriers related to product repair, this research aimed to understand user perspectives to increase product [circularity](https://www-sciencedirect-com.ezproxy.newcastle.edu.au/topics/engineering/circularity).

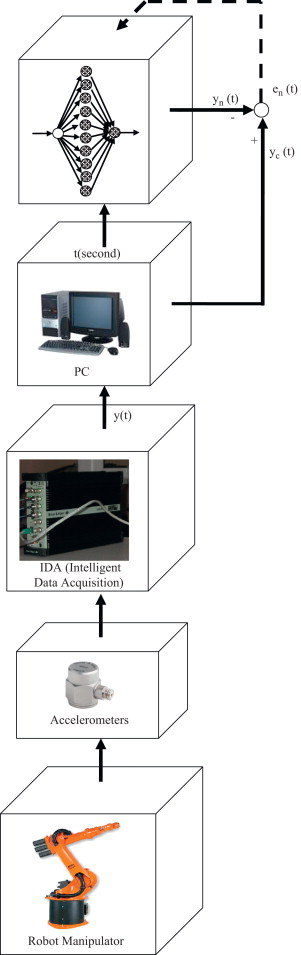


Figure 2: <https://www-sciencedirect-com.ezproxy.newcastle.edu.au/science/article/pii/S0736584510000682?via%3Dihub>

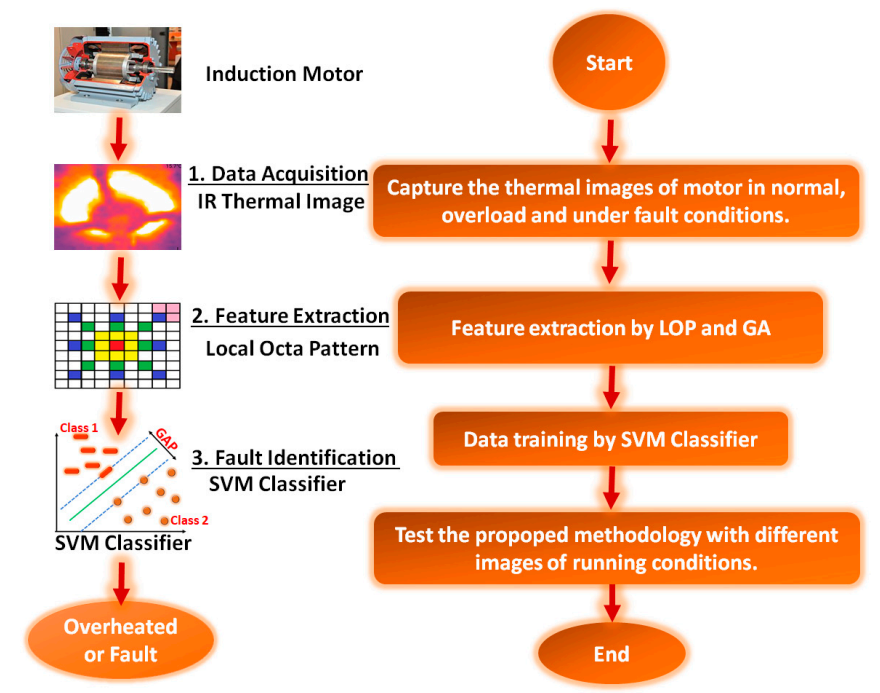


Figure 3: An Efficient Fault Detection Method for Induction Motors

The use of thermal imagining can be used to find small parts in PCBs that are not operational and should be replaced.

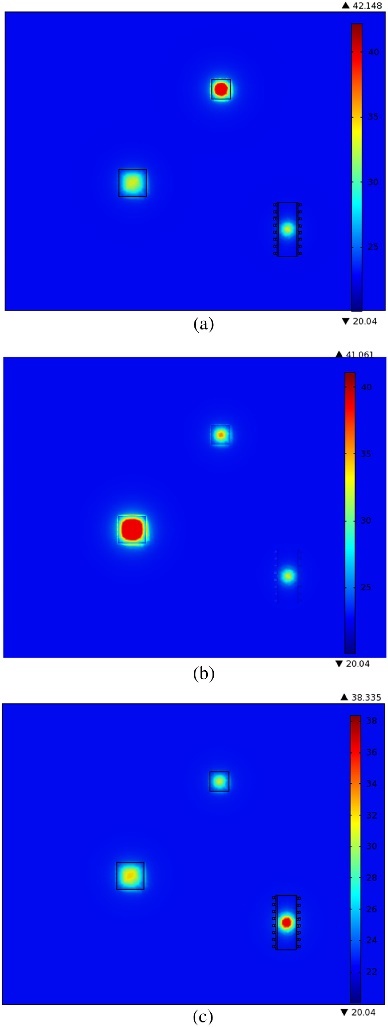


Figure 4: <https://www-sciencedirect-com.ezproxy.newcastle.edu.au/science/article/pii/S0026271417300367?via%3Dihub>

# Methodology

## Fault Detection using Thermal Imaging

A diagram of a process flow

Description automatically generated

Figure 5: <https://www-sciencedirect-com.ezproxy.newcastle.edu.au/science/article/pii/S0026271417300367?via%3Dihub>

Repair process algorithm using thermal imagining.

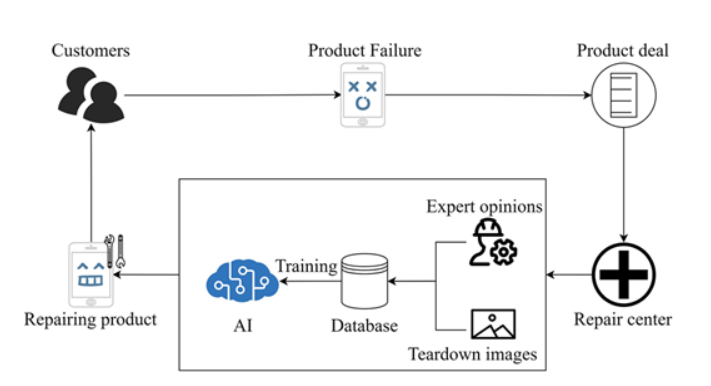


Figure 6: https://asmedigitalcollection-asme-org.ezproxy.newcastle.edu.au/manufacturingscience/article/146/2/020901/1167723/Automated-Evaluation-and-Rating-of-Product

The AI driven process to evaluate product repairability.

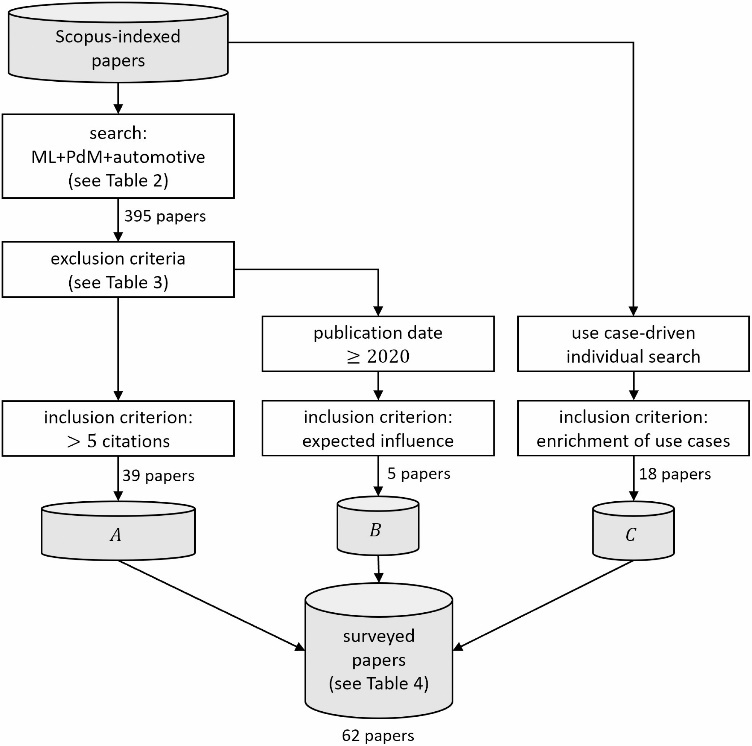
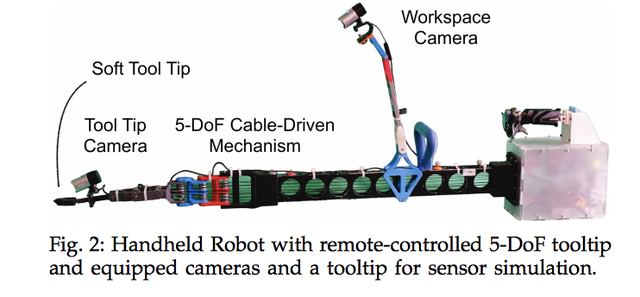


Figure 7: Predictive maintenance enabled by machine learning: Use cases and challenges in the automotive industry.

Use of this process is to get correct surveyed data from sources.



A black claw with a white background

Description automatically generated with medium confidence

# Problem Statement

# Discussion

| **Research through design repair methods** | |
| --- | --- |
| **1** | 3D printing product parts |
| **2** | 3D printed patches |
| **3** | 3D printing pen |
| **4** | kintsugi (Traditional Japanese repair method employed to mend broken ceramics with gold and silver.) |
| **5** | kintsugi for textiles |
| **6** | kintsugi sugru |
| **7** | darning |
| **8** | darning sugru |
| **9** | boro (A special way of repairing Japanese traditional clothes) |
| **10** | patching |
| **11** | sugru patching |
| **12** | basket weaving |

# Recommendation

## Future Research Path Recommendations

1. privacy matters with broken phones.
2. AI powered Phone Repair.
3. Phone Data extraction with biometrics security access.

# Conclusion

There are multiple organisations and departments working on this topic of automated repair using machine learning.

In part B we will set up a simulation of a device that can do automated repair on selective device.

# References

# Bibliography

Repair motivation and barriers model: Investigating user perspectives related to product repair towards a circular economy.

<https://www.sciencedirect.com/science/article/pii/S0959652620356900>

Repair of electronic products: Consumer practices and institutional initiatives.

<https://www.sciencedirect.com/science/article/abs/pii/S235255092100378X>

Mining consumer experiences of repairing electronics: Product design insights and business lessons learned.

<https://www.sciencedirect.com/science/article/abs/pii/S095965261631040X>

Selling 'Used' Cell Phones

<https://www.bankmycell.com/sell-broken-phones#:~:text=If%20your%20device%20has%20got,of%20the%20brand%20new%20value>

Fault Diagnosis of electronic system using artificial intelligence

<https://ieeexplore.ieee.org/abstract/document/1028367>

A More-than-Human Right-to-Repair

<https://dl.designresearchsociety.org/drs-conference-papers/drs2022/researchpapers/269/>

fault detection on robot manipulators using artificial neural network.

<https://www.sciencedirect.com/science/article/abs/pii/S0736584510000682>

An Efficient Fault Detection Method for Induction Motors Using Thermal Imaging and Machine Vision

<file:///C:/Users/USER/Downloads/sustainability-14-09060-v2.pdf>

Detection of Faulty Integrated Circuits in PCB with Thermal Image Processing

<https://ieeexplore.ieee.org/abstract/document/8946061>

Automated Evaluation and Rating of Product Repairability using Artificial Intelligence-Based Approach

<https://asmedigitalcollection-asme-org.ezproxy.newcastle.edu.au/manufacturingscience/article/doi/10.1115/1.4063561/1167723/AUTOMATED-EVALUATION-AND-RATING-OF-PRODUCT>

Model-Based Fault Detection in Electric Drivers Using Machine Learning

<https://ieeexplore-ieee-org.ezproxy.newcastle.edu.au/stamp/stamp.jsp?tp=&arnumber=1642691>

PCB-Fire: Automated Classification and Fault Detection in PCB

<https://arxiv.org/ftp/arxiv/papers/2102/2102.10777.pdf>

Learning, innovation, and sustainability among mobile phone repairers in Dhaka, Bangladesh

<https://dl.acm.org/doi/abs/10.1145/2598510.2598576>

Predictive maintenance enabled by machine learning: Use cases and challenges in the automotive industry.

<https://www.sciencedirect.com/science/article/pii/S0951832021003835>

Values in Repair

<https://dl.acm.org/doi/abs/10.1145/2858036.2858470>

Automated Detection of Printed Circuit Boards (PCB) Defects by Using Machine Learning in Electronics Manufacturing: Current Approaches

<https://iopscience.iop.org/article/10.1088/1757-899X/767/1/012064/meta>

PCB (Printed Circuit Boards) fault detection using machine learning.

<https://www.academia.edu/download/65761858/V10I2202110.pdf>

Innovations in Applied Artificial Intelligence

<https://link-springer-com.ezproxy.newcastle.edu.au/book/10.1007/b97304>

Human and Machine Communication Paradigm

<https://www-taylorfrancis-com.ezproxy.newcastle.edu.au/books/mono/10.1201/9781003392699/cyborg-kuldeep-singh-kaswan-jagjit-singh-dhatterwal-anupam-baliyan-shalli-rani>

iPhone: The missing manual

<https://newcastle.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_globaltitleindex_catalog_168269747&context=PC&vid=61UON_INST:61UON&lang=en&search_scope=CentralIndex&adaptor=Primo%20Central&tab=CentralIndex&query=any,contains,mobile%20phone%20parts%20replacement%20with%20machine%20learning&offset=0>

Hybrid machine learning algorithms for fault detection in android smartphones

<https://onlinelibrary-wiley-com.ezproxy.newcastle.edu.au/doi/full/10.1002/ett.3272>

Remote repair, diagnostics and maintenance

<https://dl-acm-org.ezproxy.newcastle.edu.au/doi/abs/10.1145/1029496.1029501>

The right-to-repair movement: Sustainability and consumer rights

<https://journals-sagepub-com.ezproxy.newcastle.edu.au/doi/full/10.1177/20438869231178037>

This Robotic arm can lend a helping hand with repairs

<https://www.popularmechanics.com/technology/robots/a29712497/robot-repair-arm/>

Premium Mechanical Arm Claw with Servo for Robot Hand, Black Metal Robot Gripper Kit, RC Fingers Paw DIY Robotic Part Manipulator Clamp for Arduino, School Science Project, Experiment, STEAM

<https://www.amazon.com/Premium-Mechanical-Gripper-Manipulator-Experiment/dp/B0BCYQQ4NG?th=1>

Phone Repair Common tools

<https://blog.repairdesk.co/2021/08/23/repair-tools-for-your-cell-phone-repair-business/>

# Appendix