Project Completion Report

MiToSafe Smart Knife Block

EGRMGMT 590-01

Master of Engineering Management

Pratt School of Engineering

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Solution Information

	Information
Solution Name	*MiToSafe Smart Knife Block*
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Document Reviewer	*Rebecca Simmons*
Version/Release Number	*V1.0*

Document History

Version No.	Date	Author	Revision Description
V1.0	12.02.2022	Shravan	Initial Submission

Executive Summary

An estimated 8,250,914 knife-related injuries were treated in US EDs from 1990-2008 and it was noticed children were more likely than adults to be injured while playing with a knife or during horseplay. With growing population and an increase in the average number of knives in domestic kitchens, these injuries are growing in number.

To counter these sources of injuries there is a requirement for a child proof design that can securely hold all the knives in, and only defined user groups (adults) are allowed to unlock the device. In our recent customer survey, 88% of customers have expressed a need for a smart child safe product for handling their kitchen knives.

To best deliver value to our target customers, we developed a self-locking, fail proof knife block that we can sell at an appropriate price point for this market. To arrive at these price points, we benchmarked the currently available child-proof product offerings in the market and analyzed their customer's feedbacks.

Our product bundle costing US $79.99 consists of a modern Smart Knife block that can be operated only by authorized users through use of secured RF Id keys and includes six high quality most used kitchen knives in US kitchens.

With our smart offering we expect to be able to break into the 'households with young (<10 years) children' market, while still supporting our luxury brand. Our product has the potential to make kitchens a safer and social place for children.

Contents

1. Company Information

Our Company designs, manufactures and markets smart consumer electronics for domestic kitchens and sells a variety of related services.

1.1 Background

Mitoso is a safe kitchen solutions company pioneering in automating kitchen cabinets and knife blocks to promote a child proof, smooth and seamless kitchen experience. Based on recent statistics by the US emergency department around kitchen accidents involving children, we passionately believe that there is a pressing need for a smart solution for this problem. We are determined to deliver an absolute, distinct, and disruptive safe kitchen experience.

1.2 Our Values

Integrity: We uphold the highest standard of integrity in all our actions

Reliability: We are personally accountable for delivering on all our commitments

Innovation: We believe in providing cutting-edge solutions

Feedback: We believe inn continuously improving through regular feedback
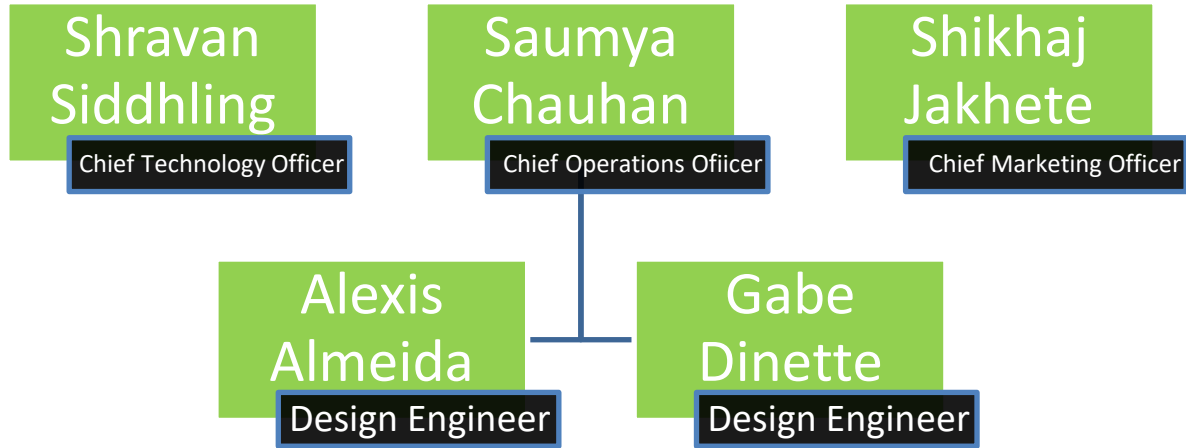
1.3 Brand Mantra

We devised our brand mantra which is clearly reflected in our product and offerings. Our brand mantra is the amalgamation of our idea and our values.
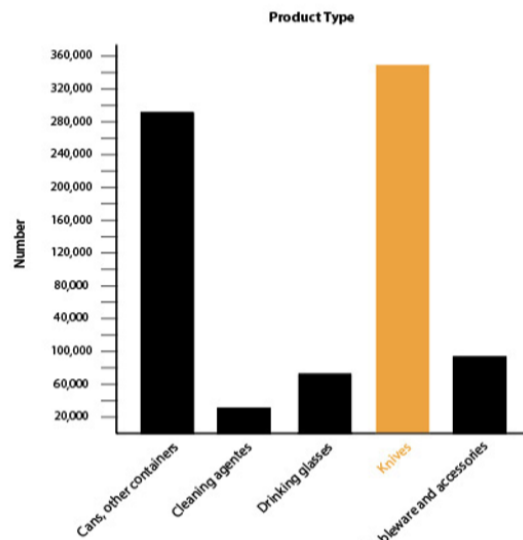
Mitoso Brand Mantra:

SMART. SMOOTH. SAFE

2. Company Structure

Shravan Siddhling	Saumya Chauhan	Shikhaj Jakhete
Chief Technology Officer	Chief Operations Ofiicer	Chief Marketing Officer

Alexis Almeida	Gabe Dinette
Design Engineer	Design Engineer

3. Research and Observations

Knife Accident Statistics

Source: US Department of Emergencies

According to the statistics by US Department of Emergencies, there was a high rate of knife injuries involving children annually in the kitchen. We inferred using the numbers provided in the statistics that every 15 minutes, 12 children in the US are injured due to knives. This

observation added to our motivation to solve this problem and made the need for our product more evident.

Existing Solutions:

1. We deeply investigated the existing market for traditional knife blocks and the attributes of the existing mechanically operated knife blocks. The traditional knife blocks revealed to have the following general attributes:
   - Wooden
   - 6-8 knife slots
   - No locking mechanism
   - Non sturdy (prone to toppling)

2. Joseph Joseph Self Locking Knife Block:
   We found a knife locking solution that is available on online and offline retailers with the following attributes:

   - Mechanical locking
   - Not fail safe
   - Not childproof
   - Plastic material

Our market research revealed that there was no smart knife block available in the market and there was a market gap we could tap into. We developed our disruptive solution based on the complaints and expectations of the customers with respect to existing solutions.

4. User Feedback

Centered around one of our core values, we conducted feedback to formulate our problem statement and our product requirements. Phase one of the feedback was a survey conducted to gauge the reception of the idea and expectations of the product.
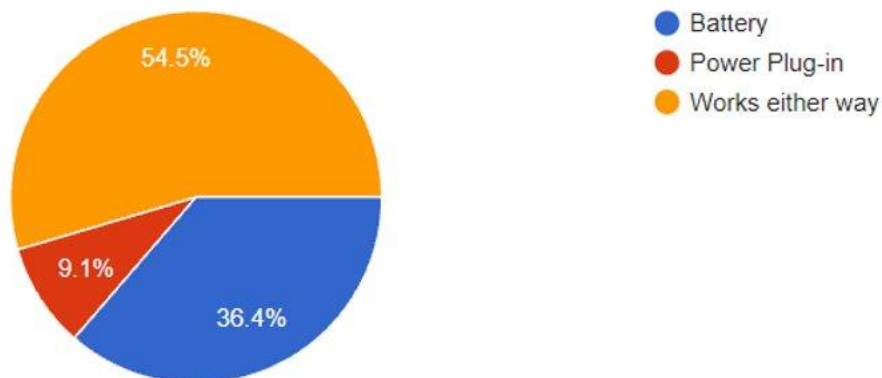
Feedback phase 1:

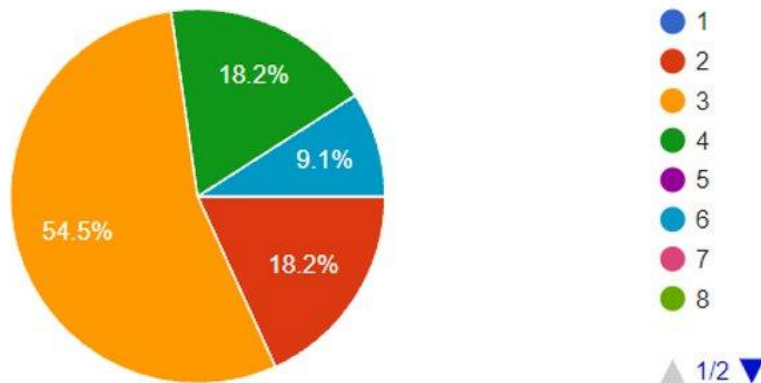The following inferences and results were drawn from the survey responses:

Preference of mode of operation of the knife block:
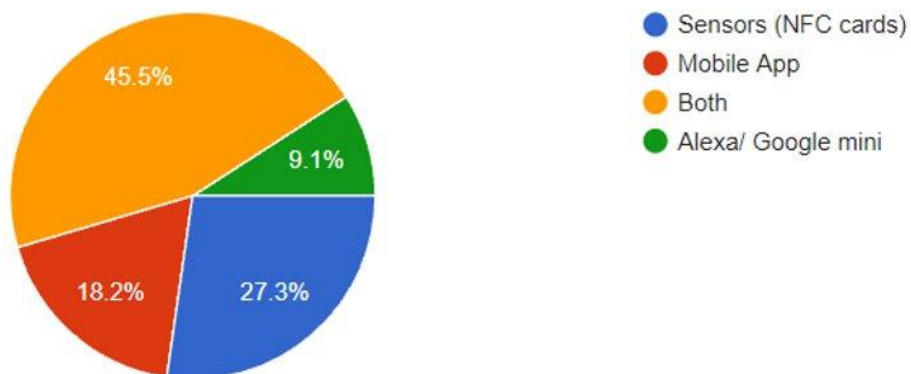
Preference of power mode:

No. of knives used regularly by prospective customers:


Feedback Phase 2:

Further, we went ahead and contacted prospective customers who had a family with small children and infants to gather insights into the state of awareness of the problem and their expectations of product offerings.

The feedback phases revealed the major functional requirements of the product and gave us direction to adhere to the needs and wants of the customers.

5. Value Chain Analysis

We ideated and formulated our value chain after recognizing the different components of the product.
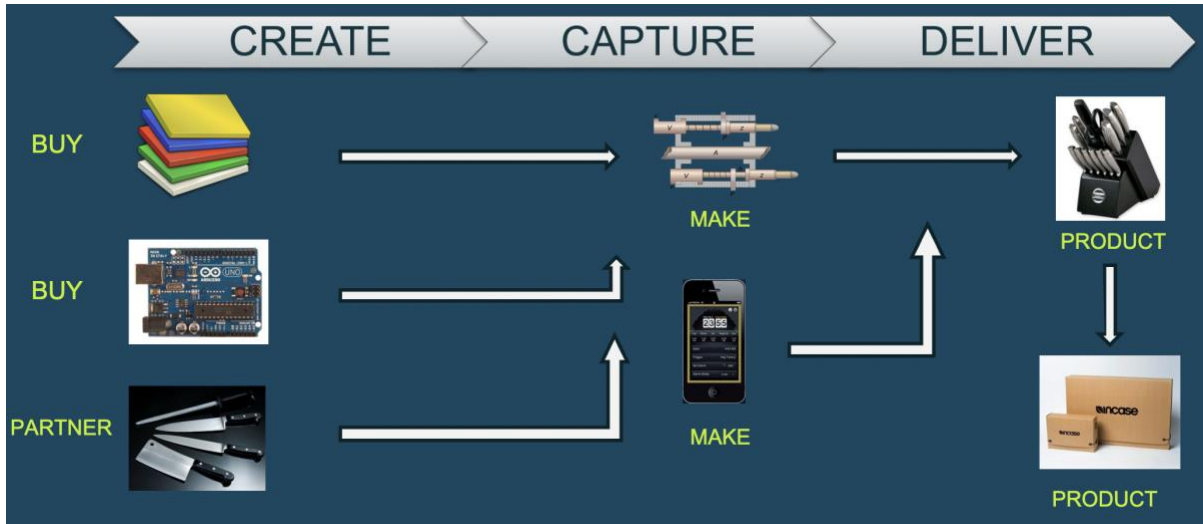
6. Make-Buy Strategy

Based on the product requirements, we formulated a make-buy strategy for capturing the value created.

7. Distribution Channels and Pricing

Direct: PULL strategy

We plan to sell directly through our website. This will have the following advantages for our brand:

- Offering promotions through the website for more visibility
- Brand promotion
- Pricing will differ on the website to promote the direct selling channel

Indirect: PUSH strategy

We will push our product into the market by selling through retailers like Amazon, Home Depot, Walmart and Target. This will have the following advantages for our brand:
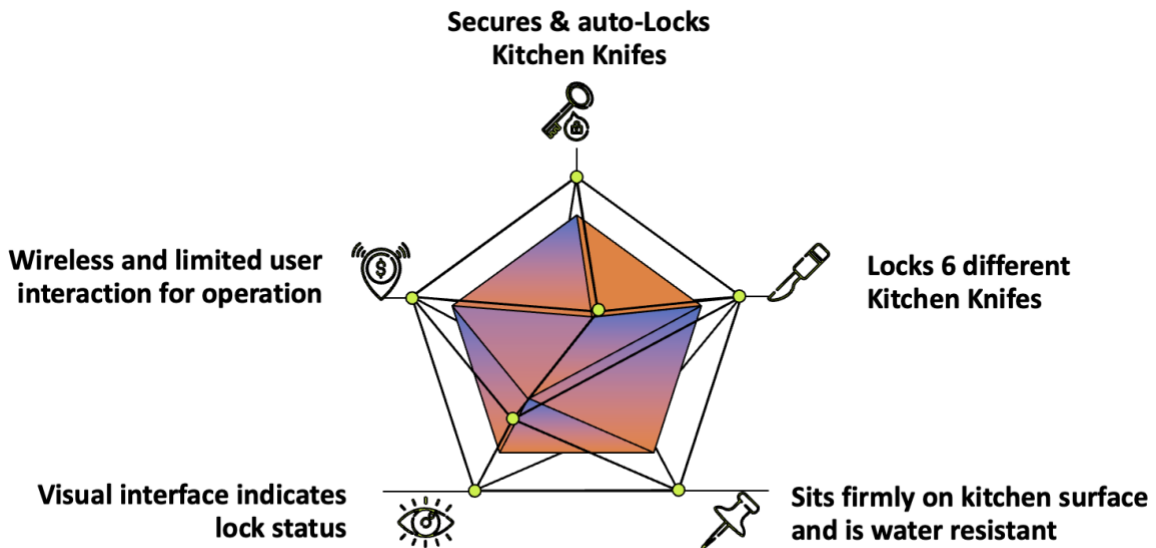
- Market reach and brand promotion
- Attractive pricing- $79.99

8. Product Documentation

Our Smart kitchen product's primary function is to provide secure stowage of potential harmful tools and of delicate items in kitchen. This is achieved via secure wireless communication to accept security access and a combination of actuators to lock and unlock the products.

To begin with a smart and secure kitchen experience, we introduce MiToSafe Smart Knife block. This product's primary function is to securely lock the knives in place and release only when a security qualified user seeks the usage and thereby reduce any potential threat of knife related accidents involving users and their children.

8.1 Functional Performance

| Requirement	Requirement Definition
Secure	Product securely locks the knives in place.
Safe	Design ensures that even under extreme forces, security does not fail.
Wireless	The system shall operate wirelessly and with minimum user interference.
Smart	The system shall compute and provide lock/unlock functions based on preassigned access levels to different user groups.
	The system shall convey operation status to the user (thru display of light/ playing a sound, etc.).

8.2 Costed Bill of Materials

| Part ID	Description	Qty	Unit Cost	Cost
1	Non- Flanged Ball Bearing (1/4" ID x 1.2" OD, 3/16" thickness)	2	$ 0.25	$ .50
2	1/4" x 8" Stainless Steel D-shafting	1	$ 0.20	$ 0.20
3	HS-488HB Servo-Clockwise (stock)-Stock Rotation	1	$ 7.59	$ 7.59
4	Servo to Shaft Coupler (H25T Spline, 1/4" Bore)	1	$ 6.99	$ 6.99
5	Cooler Kitchen 12 Piece Dishwasher Safe Knife Set	1	$ 9.80	$ 9.80
6	BTF-LIGHTING WS2812B RGBIC LED RGB PC Light Strip	4	$ 0.20	$ 0.80
7	RFID Kit	3	$ 0.25	$ 0.75
8	Solenoids & Actuators Solenoid - 5V (Small)	1	$ 1.97	$ 1.97
9	Mini Nano V3.0 ATmega328P Microcontroller Board w/USB Cable For Arduino	1	$ 4.20	$ 4.20
	Total Number of parts:	**13**	**Total Cost:**	**$ 32.80**

8.3 Structed Assembly
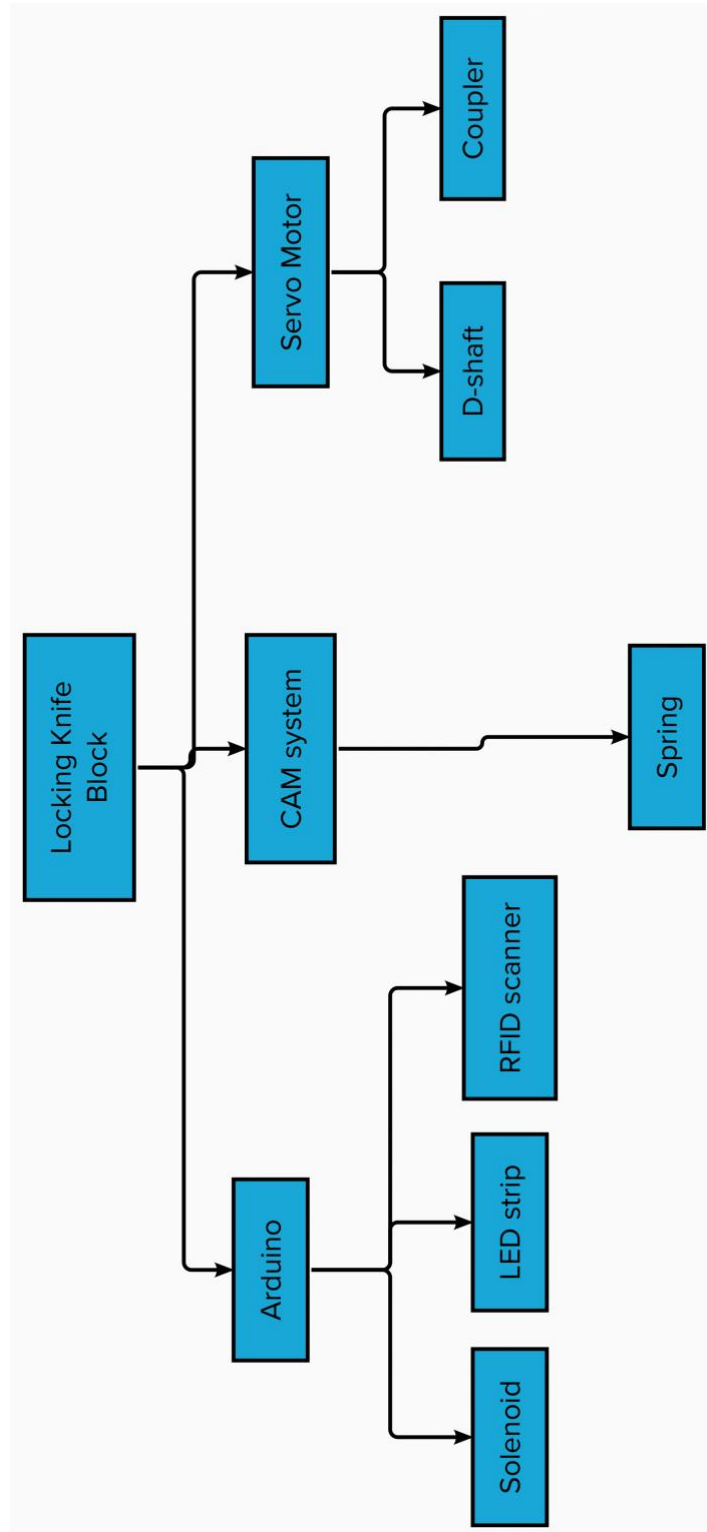
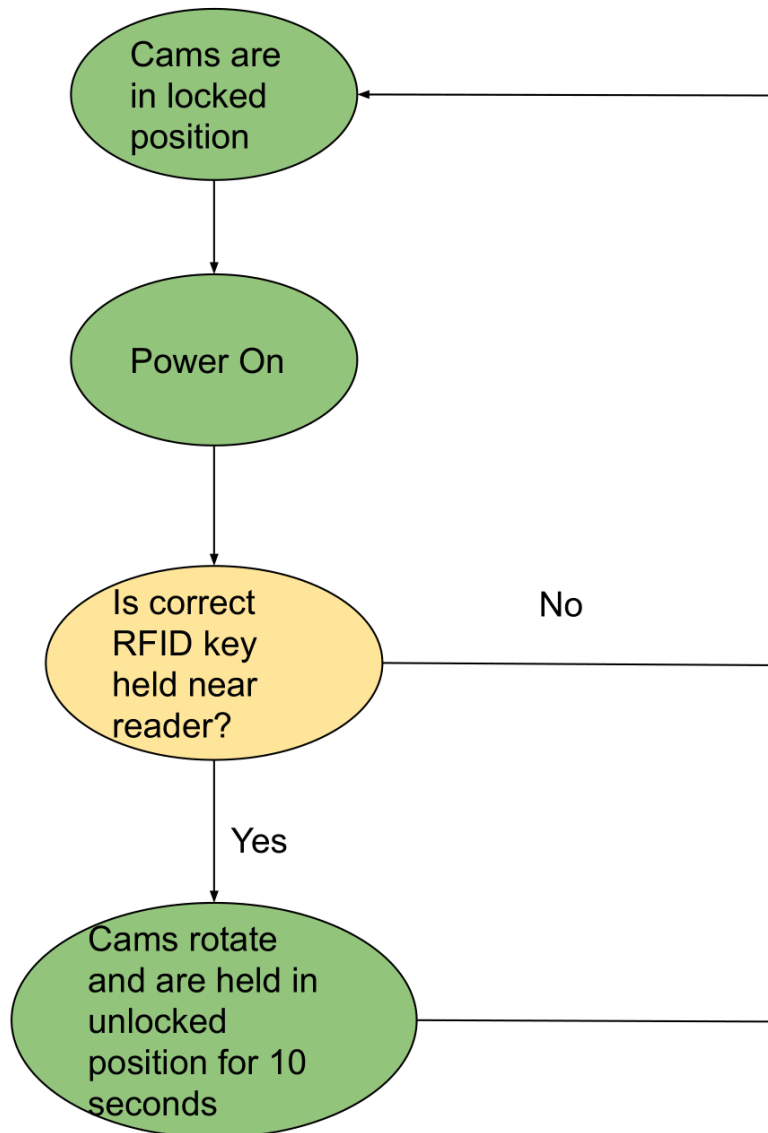## 8.4 Exploded View of the Product
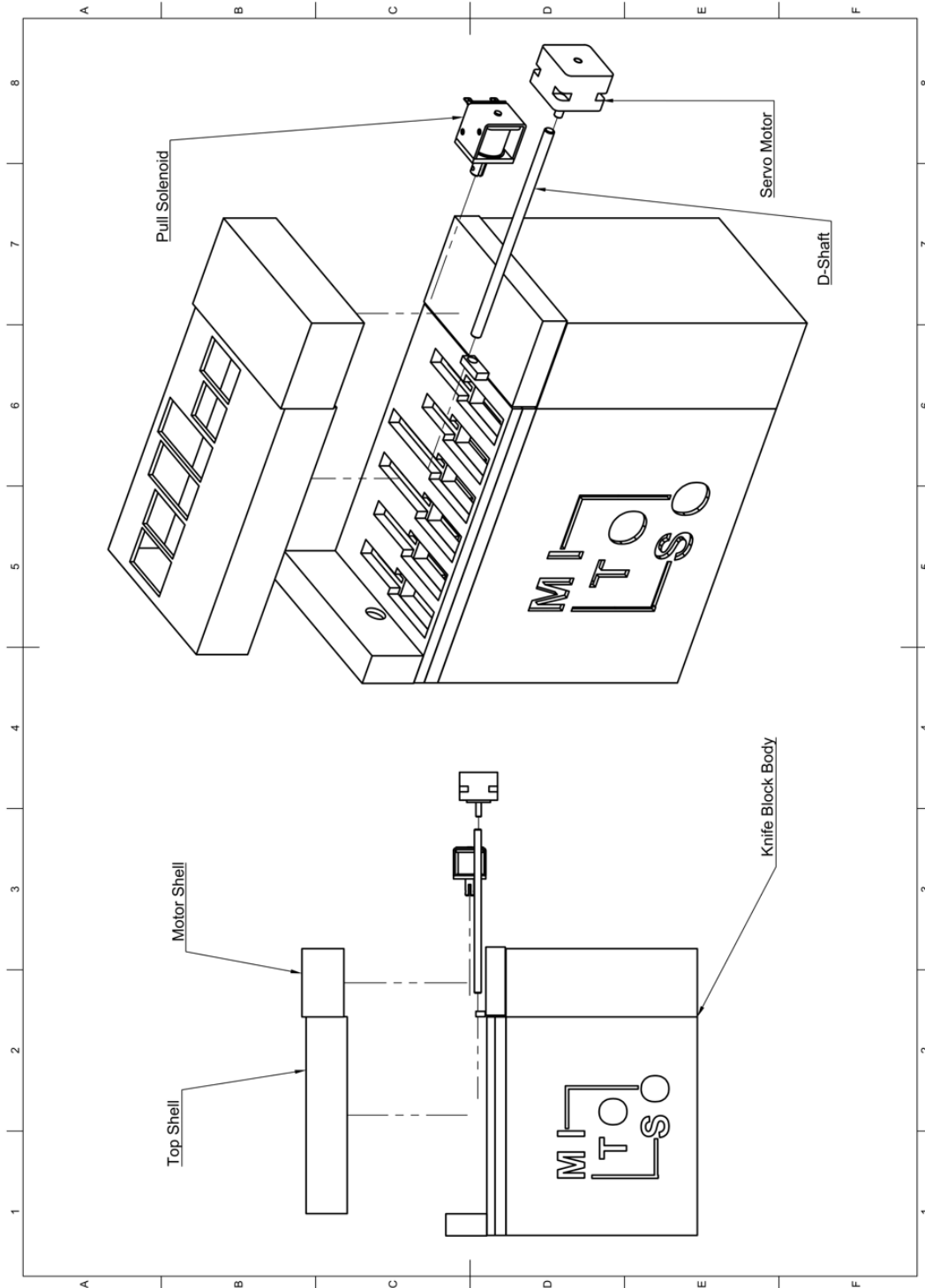
8.5 View of the Locking Mechanism
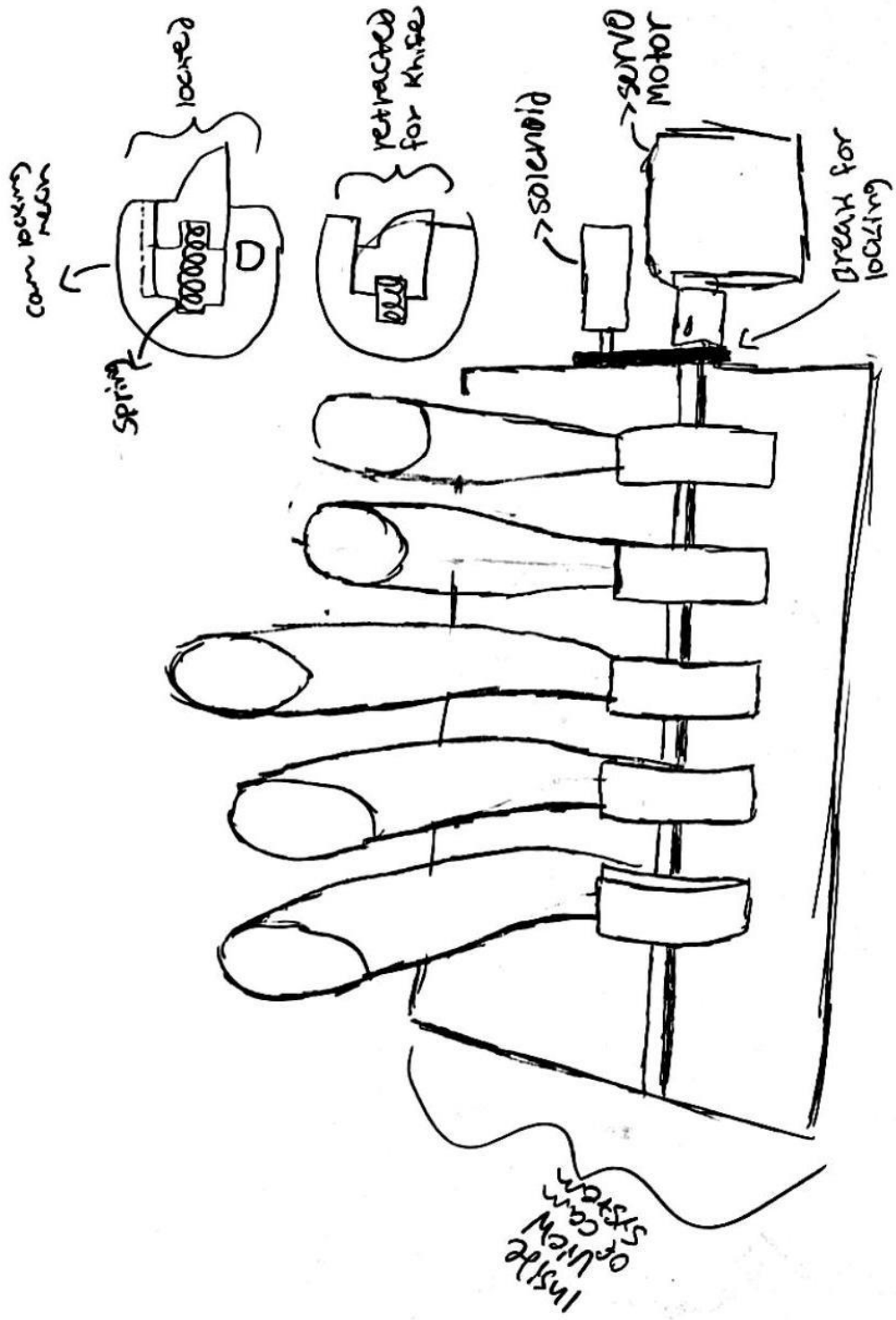
8.6 Electromechanical Diagram
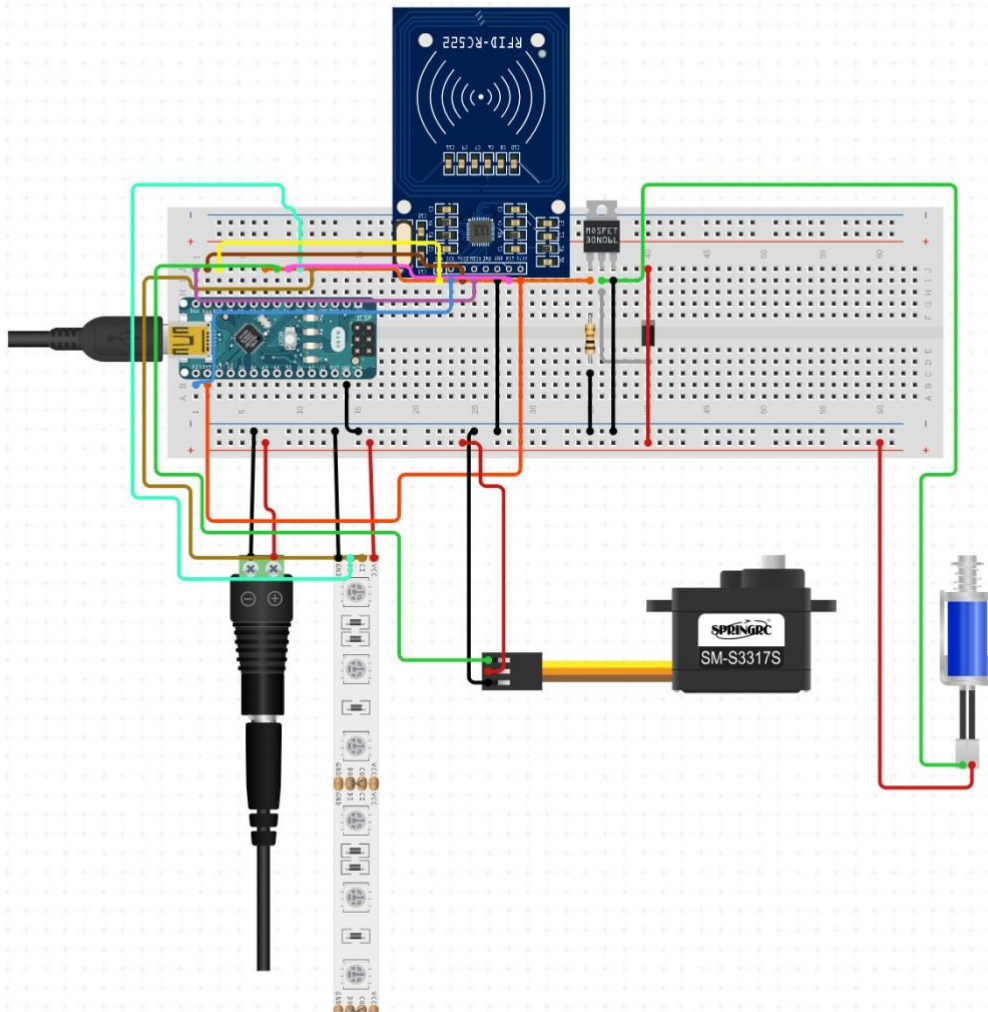
8.7 Logic Flow of Operation

9. Packaging Design

Here at Mitoso, we're determined to do things a little differently. That's why our products give a little love to you, while also caring for the planet, too. We're passionate about our recyclable packaging. While we're not perfect when it comes to sustainable brands, we will do everything in our power to make a difference.

We are improving the design and materials used for our packaging assortment. We are reducing the weight of packaging materials, while making our packaging more robust to avoid damage in the supply chain. We also added on-package messaging to inform customers about these improvements and provide guidance on how to recycle their packaging materials.

10.   Next Steps

We aspire to scale our smart solution to a comprehensive, automated childproof kitchen system and offer complementary products for a seamless transition to a Mitosafe kitchen.

Future product offerings:

 MitoSo Smart Cabinet System

 MitoSo Smart Dustbin

MiToSo Smart Kitchen Inventory

Appendix A: References

Smith GA. Knife-related injuries treated in United States emergency departments, 1990-2008. J Emerg Med. 2013 Sep;45(3):315-23. doi: 10.1016/j.jemermed.2012.11.092. Epub 2013 Jul 10. PMID: 23849364.

Joseph Joseph LockBlock: https://us.josephjoseph.com/products/lockblock-knife-block-set-black?variant=39297199013966

Ball Bearings: https://www.alibaba.com/product-detail/Bearing-Ball-Ball10-Pieces MiniatureBall_60825887141.html?spm=a2700.galleryofferlist.normal_offer.d_title.7 6d555c424NktC&s=p

Custom Stainless Steel Motor shaft: https://www.alibaba.com/product-detail/High-Quality-CustomCNCShaftStainless_60705685441.html?spm=a2700.themePage.1020113525 246.17.75eb233dVD9ecV

Servo Motor : https://www.alibaba.com/product-detail/Waterproof-Digital-9kg-Servo-for-HSP_1600344243964.html?spm=a2700.wholesale.0.0.31187d3dWbMmLS

Knife set: https://www.alibaba.com/product-detail/Super-Sharp-6-Piece-Kitchen-Hollow_1600088401742.html?spm=a2700.details.0.0.e4554972XwqV0Y

LED RGB Strip: https://www.alibaba.com/product-detail/Led-Strip-Light-Rgb-Lights-High_1600383751274.html?spm=a2700.galleryofferlist.normal_offer.d_title.290715 60EXCoU0&s=p

Microcontroller: https://www.alibaba.com/product-detail/Atmega328-MINI-USB-Nano-V3-0_1600278834415.html?spm=a2700.galleryofferlist.normal_offer.d_title.5d8633d64 Unjdh&s=p

Solenoid: https://www.alibaba.com/product-detail/Solenoid-Actuator-Solenoids-5v-Push-Pull_1600383991199.html?spm=a2700.galleryofferlist.normal_offer.d_title.6be42a4 2ULlMaw&s=p

RF Id Keys: https://www.alibaba.com/product-detail/Wholesale-custom-Epoxy-rfid-keychainTag_1600389348830.html?spm=a2700.galleryofferlist.normal_offer.d_title. 1d075c488OUvOB
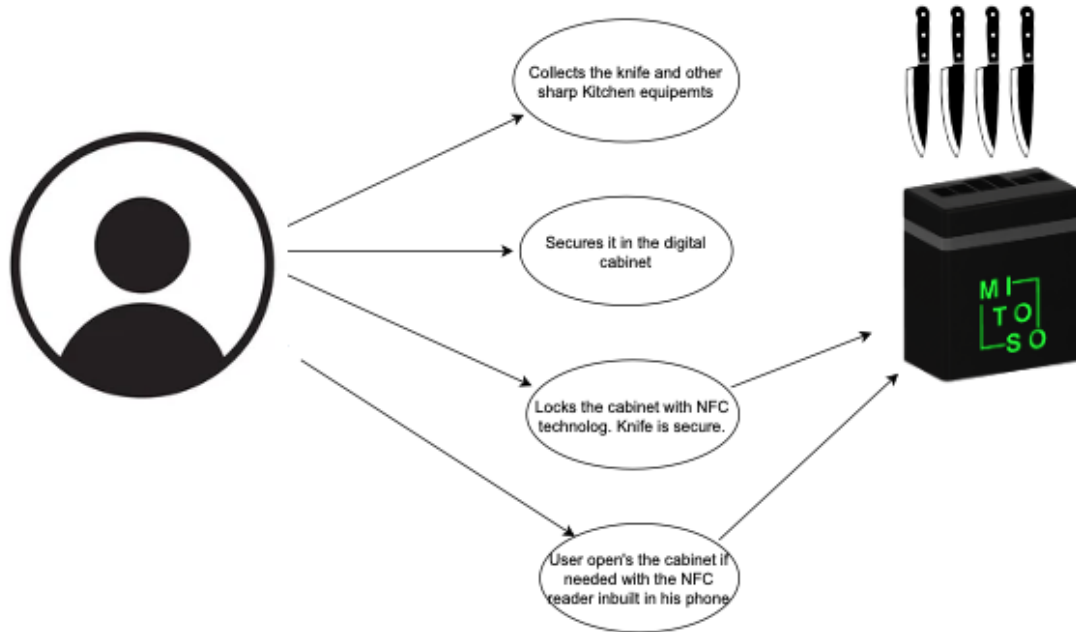
Appendix B: Use Case Diagram

Fig. User Operation Sequence Diagram

Appendix C : Logic Flow Diagram
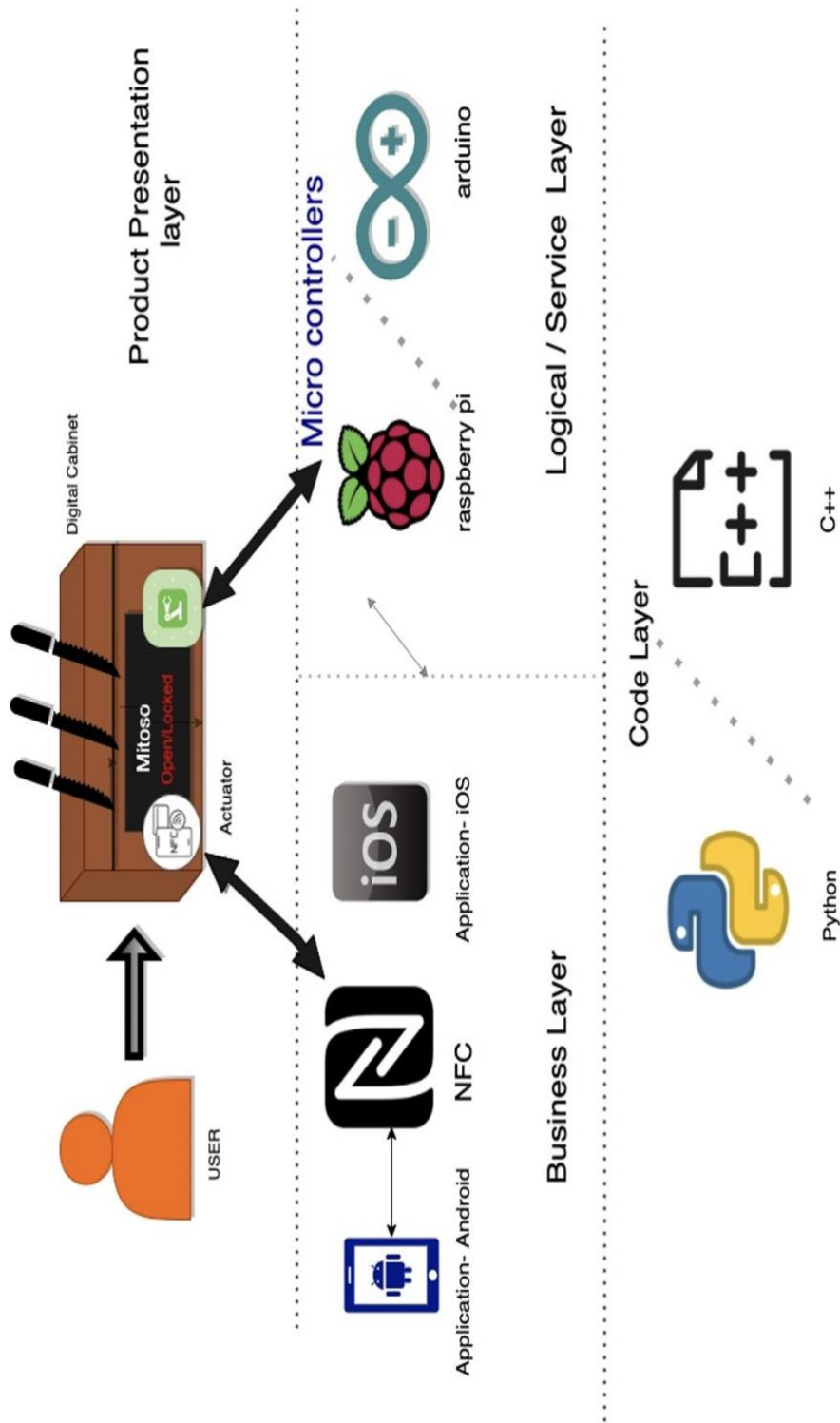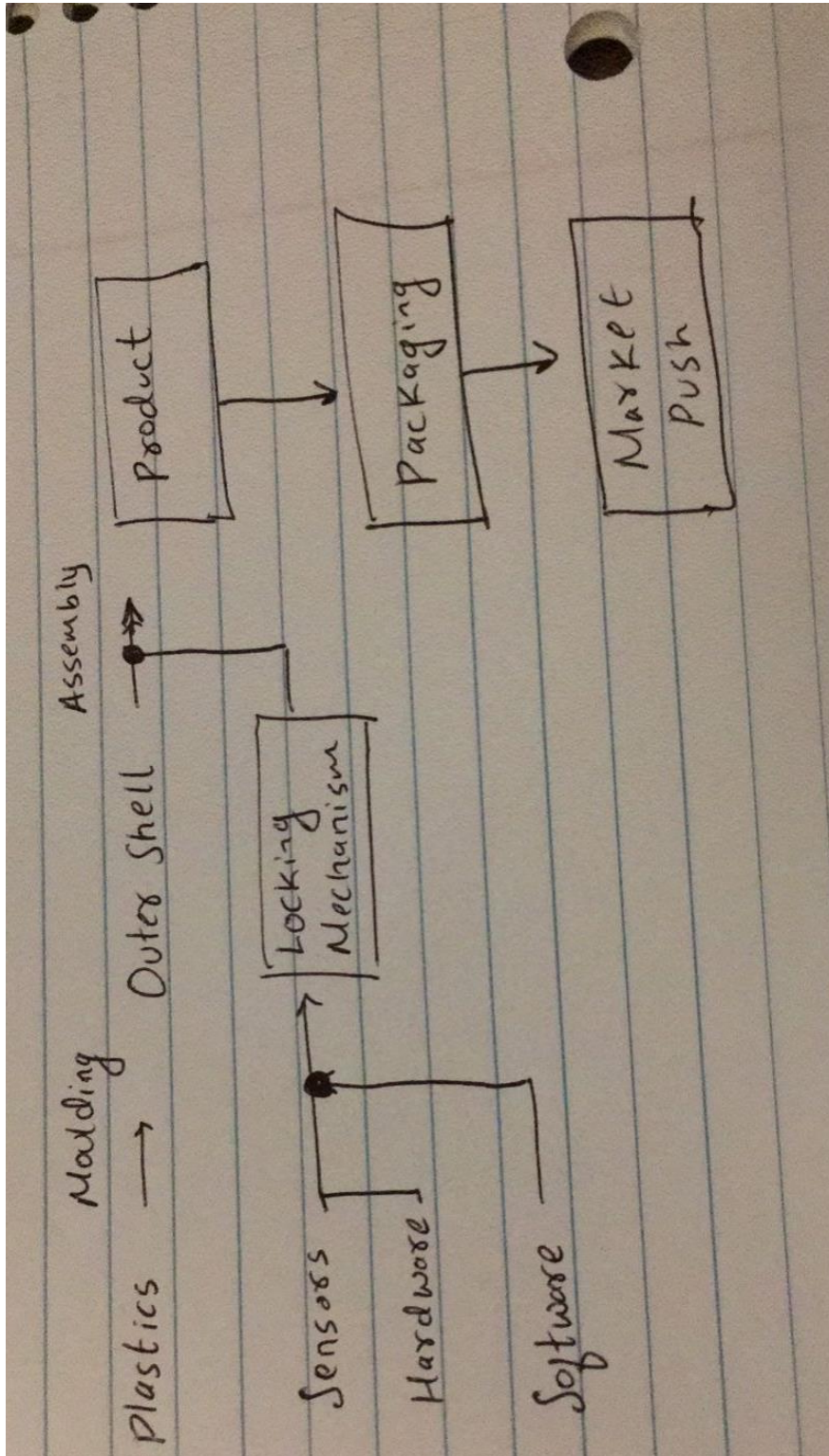

Fig. System Architecture
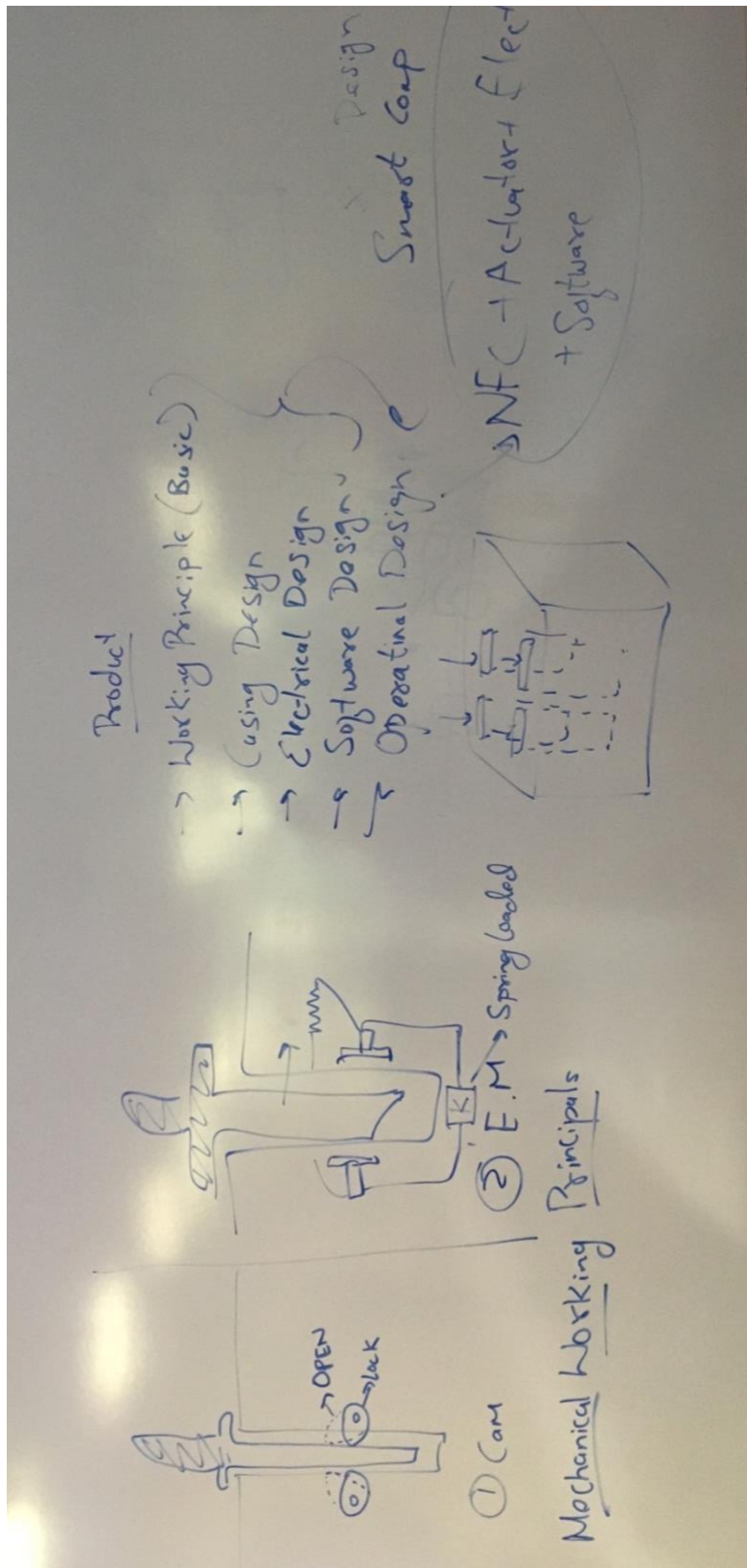
Appendix D : Sketches

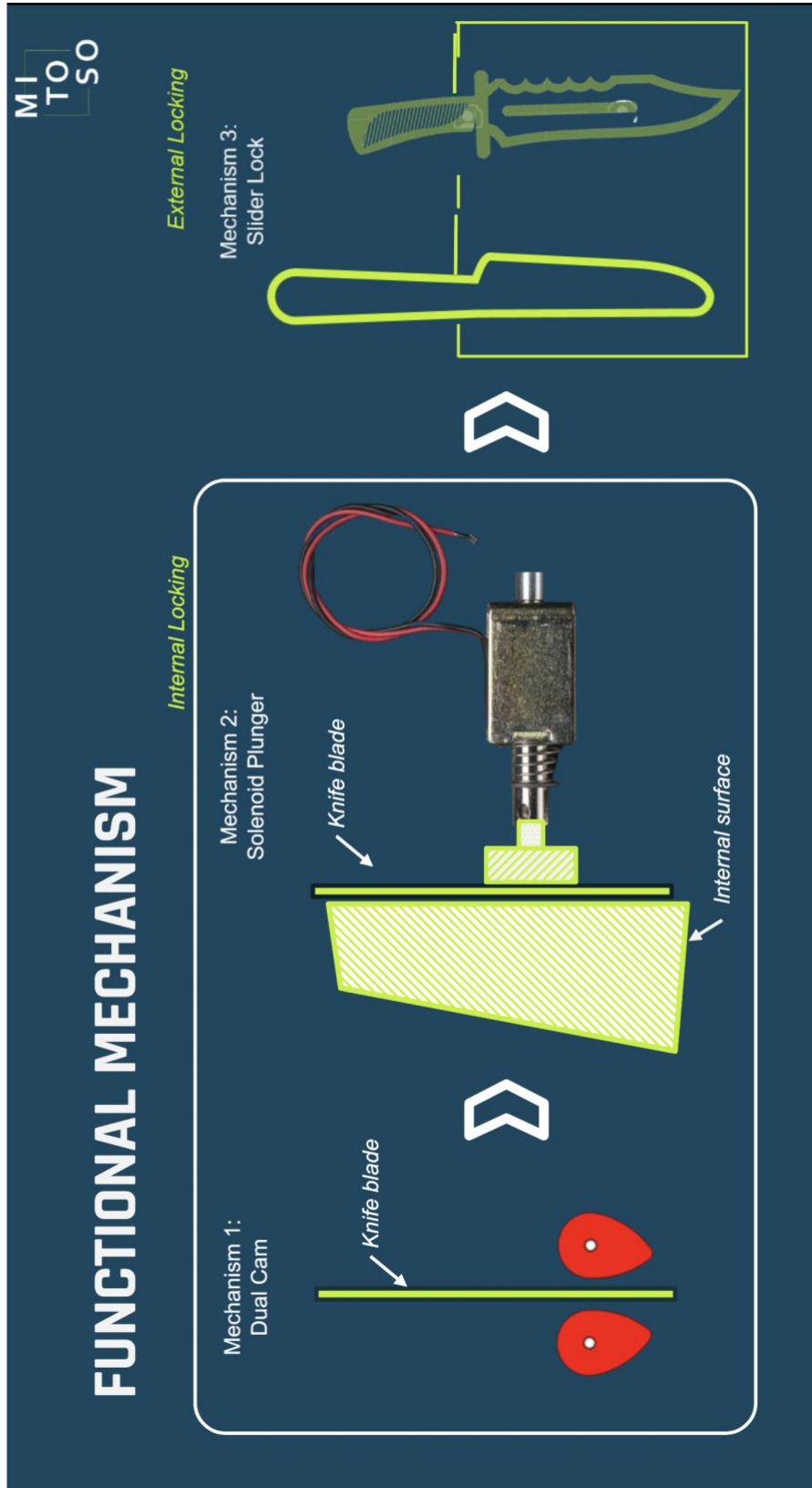**Fig. Value Chain Prototype**

Fig. Initial Mechanism Prototype

Fig. Evolution of Locking Mechanism
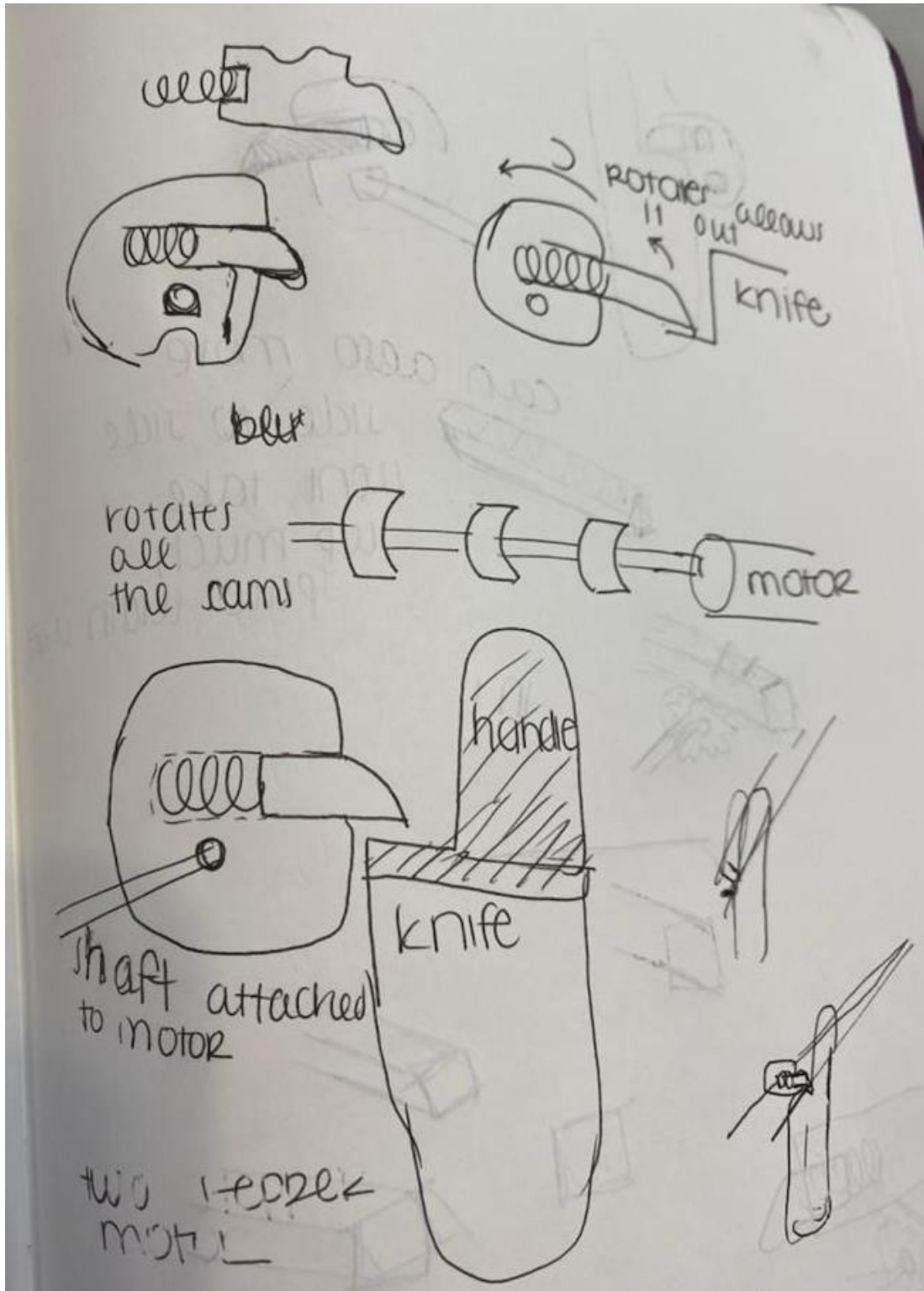
Fig. Final Working Mechanism Principle
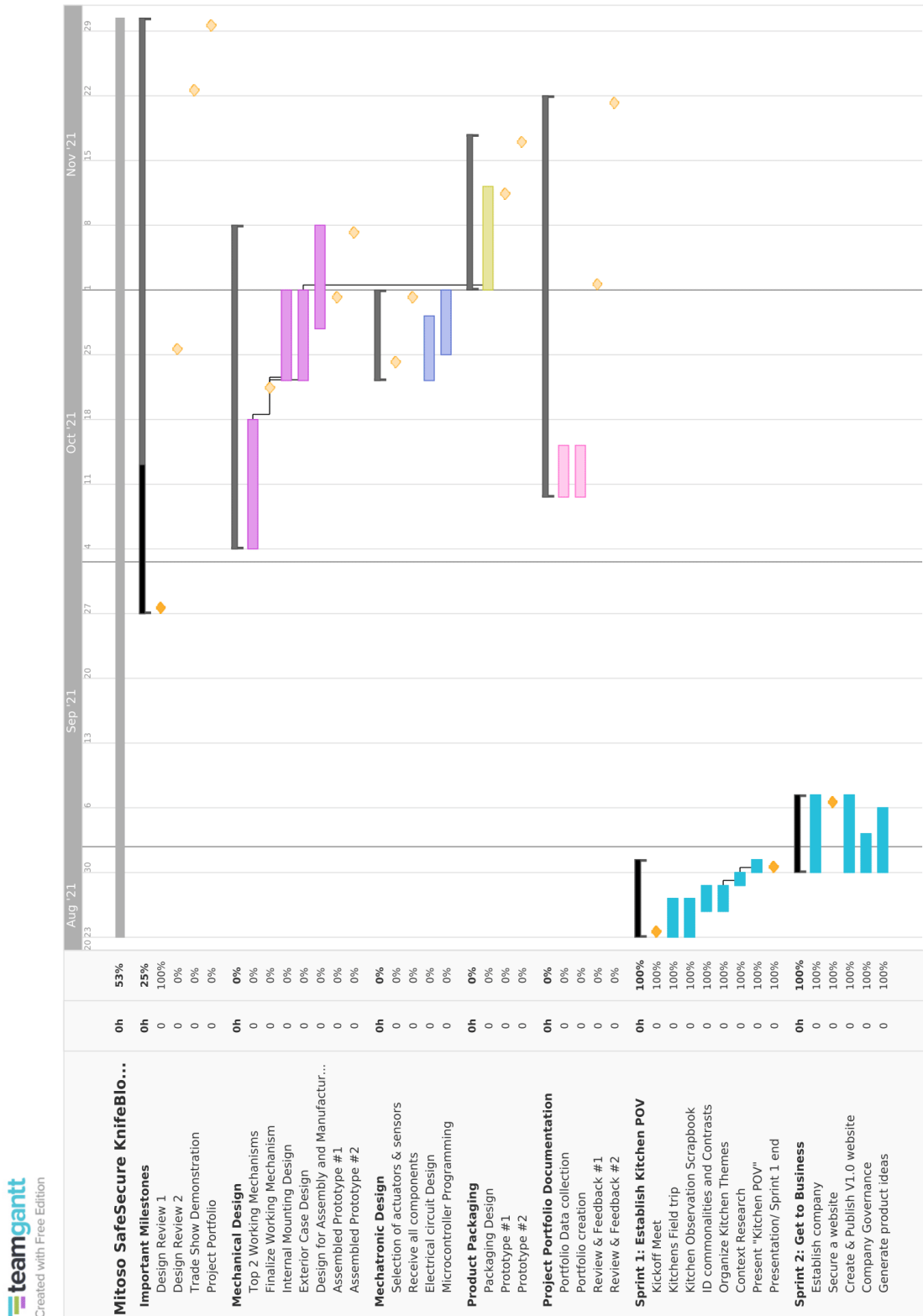
Appendix E : Project Timeline

Presentation/ Sprint 2 end	0	100%
Sprint 3: Getting Real	**0h**	**100%**
Select top 2 product Ideas	0	100%
Build Prototype #1	0	100%
Functional Spec V1.0	0	100%
Presentation/ Sprint 3 end	0	100%
Sprint 4: Getting Specific	**0h**	**76%**
Field Trip for competitors	0	75%
Finalize Product Idea	0	100%
Write Functional Requirements	0	60%
Identify Value chain	0	50%
Business Introduction and opportunity	0	65%
Build Prototype #2 (Functional)	0	100%
Solution Description	0	60%
V1.0 Design Review Presentation	0	100%
Presentation/ Sprint 4 end	0	100%
Sprint 5: Unveiling the Business	**0h**	**85%**
Competitor Benchmarking (Joseph & …	0	100%
Write Functional Requirements	0	80%
Identify Value chain	0	65%
Business Introduction and opportunity	0	70%
Design Review Presentation #1	0	100%
Presentation/ Sprint 5 end	0	100%
Sprint 6: Detail planning and Feed…	**0h**	**55%**
Stakeholder Interviews	0	50%
Stakeholder Survey	0	60%

Appendix F : Trifold Brochure

Appendix G : Poster

Appendix H : Customer Survey

Product Idea Feedback

Hello, We at Mitoso are looking to make kitchens safer for kids and aged. As a first step in this pursuit, we have a product idea of a secure knife box that locks knives in a box and avoids any unnecessary knife related accidents; and gives user the ability to control the access to their knifes in a single click. We would love to hear your thoughts or feedback on how we can improve your experience with our product!

*Required

Here is how an existing child-safe knife block looks like - mechanical and not so easy to use. We aim to making it smarter and easier to use with a user interface that would allow you to interact with the device and with no physical effort needed to operate. We will appreciate your inputs :)

1. How old are you? *
   Mark only one oval.
   - 18-24
   - 25-33
   - 34-45
   - 45-55
   - 55+

2. If you have kids, how old are they? *
   Mark only one oval.
   - 0-3
   - 4-12
   - 13+
   - NA

3. How would you prefer to lock and unlock the knives? *
   Mark only one oval.
   - Sensors (NFC cards)
   - Mobile App
   - Both
   - Other: _____

4. How would you like to power it? *
   Mark only one oval.
   - Battery
   - Power Plug-in
   - Works either way

5. How many knives do you generally use? *
   Mark only one oval.
   - 1
   - 2
   - 3
   - 4
   - 5
   - 6
   - 7
   - 8
   - 9
   - 10

6. How likely are you willing to invest in such a product? *
   Mark only one oval.

	1	2	3	4	5
	○	○	○	○	○

7. Are you concerned with your children getting hurt with knife related accidents?
   Mark only one oval.

	1	2	3	4	5
	○	○	○	○	○

8. Were you or a dear one involved with an accidental knife injury recently (due to unorganized kitchen tops and improperly placed knives)? *
   Mark only one oval.
   - Yes
   - No
   - Maybe

9. How much are you willing to invest in this product? *
   Data for your reference: The existing self locking mechanical knife box sell at USD 50 and the cost of a knife in the hand of your kid is too high.

   _____

10. Email

    _____

Appendix I : Program Code

```
#include <SPI.h>
#include <MFRC522.h>
#include <Servo.h>


#define SS_PIN 10
#define RST_PIN 9
#define LED_PIN 2  //define  LED


#define BUZZER 8 //buzzer pin
MFRC522 mfrc522(SS_PIN, RST_PIN);   // Create MFRC522 instance.
Servo myServo; //define servo name


#include <FastLED.h>


#define NUMOFLEDS    40
CRGB leds[NUMOFLEDS];


void setup()
{
  FastLED.addLeds<WS2812, LED_PIN, GRB>(leds, NUMOFLEDS);
  Serial.begin(9600);   // Initiate a serial communication
  SPI.begin();      // Initiate  SPI bus
  mfrc522.PCD_Init();   // Initiate MFRC522
  myServo.attach(8); //servo pin
  myServo.write(0); //servo start position
  pinMode(LED_PIN, OUTPUT);
  pinMode(BUZZER, OUTPUT);
  noTone(BUZZER);
  Serial.println("Put your card to the reader...");
  Serial.println();


}
```

```
void loop()

{

  // Look for new cards

  if ( ! mfrc522.PICC_IsNewCardPresent())

  {

    return;

  }

  // Select one of the cards

  if ( ! mfrc522.PICC_ReadCardSerial())

  {

    return;

  }

  //Show UID on serial monitor

  Serial.print("UID tag :");

  String content= "";

  byte letter;

  for (byte i = 0; i < mfrc522.uid.size; i++)

  {

    Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");

    Serial.print(mfrc522.uid.uidByte[i], HEX);

    content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));

    content.concat(String(mfrc522.uid.uidByte[i], HEX));

  }

  Serial.println();

  Serial.print("Message : ");

  content.toUpperCase();

  if (content.substring(1) == "33 3F 4D 16") //change here the UID of the card/cards that you want to
give access

  {

    Serial.println("Authorized access");

    Serial.println();

    delay(500);


  for (int i = 0; i <= 39; i++) {

  leds[i] = CRGB ( 0, 255, 0);
```

```
   FastLED.show();
   delay(40);


   tone(BUZZER, 500);
   delay(300);
   noTone(BUZZER);
   myServo.write(95);
   delay(5000);
   myServo.write(0);
   tone(BUZZER, 600);
   delay(300);
   noTone(BUZZER);
   delay(200);
   tone(BUZZER, 600);
   delay(300);
   noTone(BUZZER);
   digitalWrite(LED_G, LOW);
  }

 else  {
   Serial.println(" Access denied");
   digitalWrite(LED_R, HIGH);
   tone(BUZZER, 300);
   delay(1000);
   digitalWrite(LED_R, LOW);
   noTone(BUZZER);
  }
}
```