Innovation Pilot 62990
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The Company proposal and solution report

"AluBox"

Group 12

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1. Abstract

AluBox is a company, that has been manufacturing aluminium boxes since 1999. AluBox is always interested in the development of their aluminium boxes moreover it becomes easier and safer to use for the different purposes and equipment.

The used methods in this report were different, because it aims to implement an electronic lock for the AluBox.

It started by making a stakeholder analysis for the different clients to ensure the safety and effectiveness of the AluBox will matches their needs, and to get an overview of their main requests. After that, the group started by defining the task, and the different perspective were discussed to find the best solution. After that, the implementation was done, in a way that suits everyone, and helps the clients as much as possible.

Finally, it can be concluded that the lock is very effective, the lock has been manufactured according to the specifications that suit the user's demand. The price of this lock with all these technologies that are characterized by it, and which are scalable, its price is about 300-500 kr.

2. Introduction to Business Plan

AluBox was founded in 1999 and is a privately owned family business that has been passed down for 3 generations. There competence lies in production of aluminium boxes. AluBox have a wide variety of standard aluminium boxes that are sold to costumers all over the world.

The AluBox is manly used for expedition, outdoor, overlanding, industrial, defence, offshore and data carrier all over the world. Alu-box ensure safe transportation and storage of valuables, fragile items, and sensitive equipment.

Because of the large marked of different aluminium boxes AluBox wants to stay ahead of the competition by further development of their boxes. One of the tasks given by AluBox to the group was the further development of their lock on the box. AluB½ox wants the group to find a way to implement an electronic lock into the aluminium box instead of the locks that are on the box now.

3. Problem statement

By using different methods, analysis tools, and gathering quantitative and qualitative data it was enough to address “AluBox” challenge of how satisfied hunting club member' segment will be by securing their weapons boxes with an electronic lock idea.

3.1 The Hard Nut

“**How do” AluBox” can implement an electrical lock on their boxes.**

4. Your proposal and the reason for it

The task that we are working on is to find a solution on how we implement an electrical lock to the boxes so that the AluBox ensures safe transport and storage for valuables, fragile items and sensitive equipment.

After a long discussion with the team and sharing the different perspectives, we concluded that we should aim to provide a simple project where a secure password will act as an unlocking system.

To find the right solution, project group has done some research about the problem and define it, so the project group started by desk-research about the methods to replace the traditional lock systems which use mechanical lock and key mechanism by new advanced techniques of locking system. Afterwards our aim was to analyse the problem from an economic and technical perspective. The team also gathered some information from meetings with the company who answered several questions received from our group as well as other groups.

The techniques project group decided to apply are an integration of mechanical and electrical intelligent devices.

After discussion with the team members and talk about the positives and negatives, project group plan to find an innovative way to an automatic lock system consists of electronic control assembly, which controls the output load through a password. This output load can be a motor or a lamp or any other mechanical/electrical load.

One of the most important things is ensuring the safety and effectiveness of this simple embedded system with input from the keyboard and the output being actuated accordingly.

All these things will ensure the optimal result to the box lock System and once the correct code or password is entered, the box is opened, and the concerned person is allowed to access. Again, if another person tries to open the box, it will ask to enter the password. If the password is wrong, then box would remain closed, denying access to the person.

5. Business Analyse & Boundaries

In any project, some challenges will arise in order to achieve the optimum data that to be able to achieve a good result. This project has worked during the report period based on some individual primary data in the form of qualitative studies, through mails with target segment, as well as quantitative one, through surveys to some of hunting clubs.

For that cause project group has used a different methods and tools to address and get to know the market, segments, competitors, and other information that will come to gain for “AluBox” purpose in implement an electronic lock.

On other hand, there are a several limitations that the project group has made for project boundaries to mark a cut-off point: a start and an end, and a limit on what the project comprises. They also mark off its various components, hence acting as markers for milestones. These

provide a sense of direction and progress for the project. First project group has taken Denmark in their studies even though "AluBox" is international company and has costumers all over the globe, Second the project group wrote a full report without implement it on physical prototype because of materials limitation but full simulation of the lock has been done.

In the section below project group has addressed these methods and tools for understanding and analysing the market from different perspectives.

5.1 Stakeholder analysis

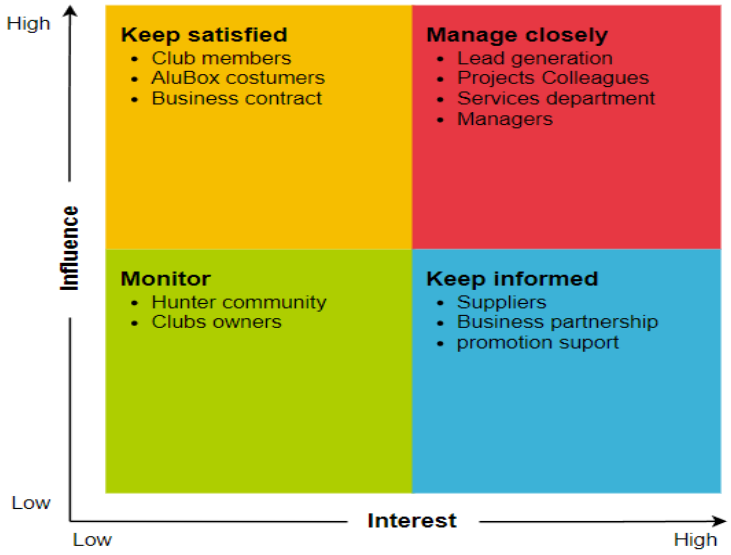

Figure 1 Stakeholder analysis (SA)

In this section project group made stakeholder analysis (SA) which identifies each stakeholder, describes their needs or desires with respect to the project and whether they are a primary (key, directly involved) or secondary stakeholder, and analyses how much interest in and influence over the project outcomes they have. Therefore, a stakeholder method has been used to give an overview about four main partners to the "AluBox" firm and that is shown in the model above.

As shown in figure 1 for categories the stakeholders analyse, which has been divided from low to high on the X and Y axis which means the importance of the stakeholder.

Keep Satisfied & Keep informed those are which competitors can have an influence on which strategy choice is used, as well determination of price etc.

Monitor (green) part as Hunter community which project group should take their advice in account and be attentive to them but it's not necessary to inform them with everything.

The last part (red) is an important to work close with them and involve them almost in everything from which strategy, price, prototype and all details because they are project owner and whole project can be stopped if they don't participate in it.

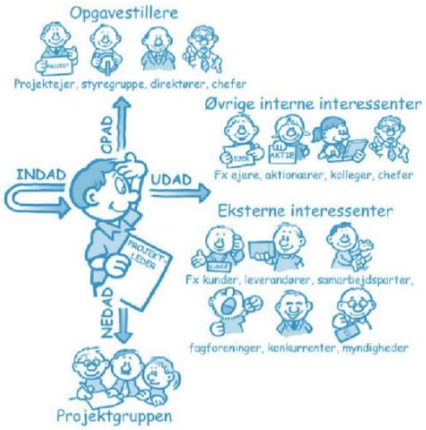

Figure 2 Stakeholders identification

Looking from figure 2 the project manager upwards, the task owners are defined which in this case are the producers, as described in the given task description. If you see that outwards there are a number as described in the given task description.

If you then see that outwards there are several external stakeholders such as competitors, authorities, customers and suppliers. Downward implies the project group, which in this case consists of the team of engineering that works on this project.

5.3 Business model canvas

Business Model Canvas

Designed for:	*Designed by:*	*Date:*	*Version:*
AluBox	Group 12	xx-xx-xxxx	xx

Key Partners
1- Truck Suppliers
2- Equipment Suppliers.
3- Aluminum companies suppliers.
4- DTU
5- Taxes and government

Key Activities do partners perform
1. Optimization and economy of scale
2. Reduction of risk and uncertainty
3. Acquisition of particular resources and activities

Key Activities
1- Satisfaction surveys
2- Repairing plans
3- Company relations
4- Customer service

Key Resources
1- Suppliers .
2- Hunt Clubs .

Value Propositions
1- Safety
2- Security
3- Quality
4- Cheap Solution
5- Usability

Customer Relationships
1- Satisfaction surveys
2- Campaigns
3- Offers

Channels
1. Website
2. Mails
3. Social media
4. Physically

Customer Segments
Hunt clubs' members

Cost Structure
All the raw materials to produce solid boxes are the most expensive.
High quality , safe and secure boxes.

Revenue Streams
- Security and safety
- Give the right to the customer to use and try the product with 30 days guarantee to return the payment.

Figure 3 Business Model Canvas

1- Key partners

Our goal from the beginning was to create a competitive advantage that has set of qualities that give a Alu-box an edge over the competition. Understanding the basic principles of competitive advantage is critical to developing effective business strategies, investing successfully and in the long run, this strengthens the company's position in the industry and ensures more sales than its competitors. Often multiple factors combine to create a competitive advantage, such as:

- product quality
- strategic pricing
- customer service
- Market positioning
- Distribution Network
- Innovation and access to new technologies

Project group has made a great effort to innovate a product that can combine most of these elements to make our product more attractive to our target market. We have also considered that it is very important that the factors that give companies a competitive advantage are sustainable. The more reliable a company's competitive advantage is, the more likely it is for the company to maintain its profit level and prevent competitors from overtaking it.

The key partners and suppliers can be:

1- Truck Suppliers
2- Equipment Suppliers.
3- Aluminium companies' suppliers.
4- Partner Universities
5- Taxes and government

The Key Activities do partners perform can be:

1. Optimization and economy of scale
2. Reduction of risk and uncertainty
3. 3-Acquisition of particular resources and activities

- **How we create a competitive advantage?**

Creating a competitive advantage is the goal of every successful business. So, this is one of our top priorities because if our company can create and maintain a competitive advantage, you can position AluBox as a market leader. This ultimately leads to more sales and potentially higher profit margins.

The difference

To stand out from our competition, our company's products must offer unparalleled value to our target audience. To do this well, we should have a deep understanding of our ideal customer. We need to find out what they want or need and how our products can improve their lives. So, we created a survey and sent it to our target audience. We send it to over 12 hunting clubs. There was consensus that it would be a good idea to have an electronic lock for the box with a recorder that records every opening and closing

Cost advantage

Another strategy for gaining a competitive advantage is to focus on cost leadership. This strategy relies on the philosophy of providing the best value to customers at the lowest cost. We do this by doing the following: Improve operational efficiency Find more effective sales channels Negotiate low prices for materials needed to manufacture products Find a balance between delivering high value at the lowest cost, rapidly increasing market share, and further reducing the cost of a product or service.

2- Types of Key Activities

Production

These activities relate to designing, manufacturing, and delivering many locks in substantial quantities and of superior quality.

Problem solving

Looking at the problem of each customer separately, there are customers who prefer the electronic lock, and there are customers who want other additions, so if we can meet all customers' needs and solve their problems, this will give the company a special place in the labour market.

The key activities can be:

1- Satisfaction surveys
2- Repairing plans
3- Company relations
4- Customer service

3- Value proposition

The new design of lock has many different advantages. The protection system, the alarm device, and the kinetic sensors, and the recorders on the existing memory, etc., will make the customer happy when purchasing this product because it is a product that has a high value and will solve many problems for the customer. There are some things that need to be kept in their physical form - whether it's personal documents such as birth certificates and passports or business documents such as valuable legal documents and agreements and the weapons of the hunters etc. this electronic lock will save your valuables from vandalism, robbery and other factors that can cause loss or damage to things. There are many reasons for using this lock, these include: Avoid theft, Protection against disasters and incidents and avoid lost documents.

One of the most well-known reasons for buying security locks is to avoid theft. With a secure box, you can give access to authorized people by giving them a PIN code, so you know exactly who has access and who doesn't. Allowing selective access will protect one's valuables from unauthorized persons and prying hands. No matter how organized you are, there is always the possibility that your belongings will be moved, misplaced or lost.

By placing your most valuable documents in a safe, you always know exactly where the documents are. The safe takes all the guesswork out of where important items are.

As mentioned earlier, you can also limit access to selected people and thus control who gets access to valuables in the safe. This will prevent one's important documents from falling into the hands of the wrong people, and therefore minimize the risk of losing one's valuables.

Hiding weapons in a safe place that provides protection from the hands of intruders

4- Customer Relationship

Our focus has always been on hunting clubs and our target audience will be the hunters who want to protect their weapons in an electronic lock box that will make them feel safe, this product will be valuable to them, and this is what their answers proved in the survey we sent him.

We maintain the relationship to customers and ensure their satisfaction by doing:

1- Satisfaction surveys: good companies ask customers' opinions. Great companies act on them.
2- Campaigns: To Attract and Retain Customers.
3- Offers: The Importance of getting new customers and boost the Company.

5-Customer Segments

Customers comprise the heart of any company business model. Therefore, in any company there should be a segment that the firm aim to reach. Project group choose to after analysing the AluBox market and the currently segment of customers. There was a new segment can be reached and gain form it. Project group in order to better satisfy the new segment which is members of hunt clubs that using weapons and want to secure it in safety boxes.

AluBox can reach customer segment through different distribution channels, which require different types of relationships that can be found furthermore in the canvas model.

6- Key Resource

Every business model requires key resources that allow AluBox to create and offer a value proposition, reach market, maintain relationship with customers segment, and earn revenues. Project group found different key resources can be a start way to AluBox for inter the market through them. Hunt Clubs and suppliers are very good key resources by reaching the new segment.

7- Channels

Whatever the contact channels, most customers get in touch because they need to. Not because they want to.

So, how do we make sure we're offering support and solving problems fast?

The answer is simple: we need to offer the right contact channels for our customers' needs.

Contact channels can be:

1. Website
2. Mails

3. Social media
4. Physically

8- Cost structures

It is important to know how much we will spend on key resources, partners, and activities

All the raw materials to produce solid boxes are the most expensive costs according to the company.
The company approach is a value driven approach, which ensure High quality, safe and secure products.

9- Revenue streams

We want to ensure that customers purchase the company products considering how much will it cost them and providing them with a good and flexible methods to pay. We could attract the customers by ensuring the ssecurity and safety of the products and by giving them the right to use and try the product with 30 days guarantee of returning the payment.

5.4 Value Proposition Canvas

Most new products and services fail to meet customers' expectations and disappear it is only possible to avoid failure by learning about the customers' problems and granting them the features and functionality they are indeed for, and that's what a value proposition canvas can help the company with ,the value proposition canvas originates from the business canvas this is a sort of shortened business plan designed to create the value of the company idea by breaking it down into essential components the definition of value proposition canvas is a tool used for designing, testing, and visualizing how the product is valued by customers. It is made up of two parts: the customer profile circle and the value map square. Each board is divided into three sections describing specific aspects of a customer or product. The figure below is an illustration of the Value Proposition Canvas. The circle on the right depicts a customer segment and explains their motivation for purchasing the product, their gains, their pains, and why they need the product. The circle on the left shows the value map which describes products and services.

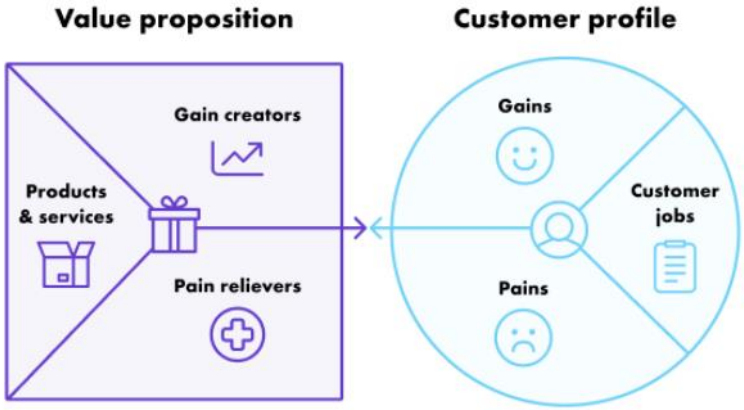

Figure 4 Value Canvas

These two shapes of Value Canvas represent the value proposition and customer. They both help to understand AluBox market and how can best deliver the product.

The customer profile represents the customer where it's divided into three parts:

Jobs: include all the tasks that project group segment want, which are people who have weapons and want to save it in secure place and hard to reach. These jobs can include security, attractive boxes and registering of box usage that will help owners to know how and when their boxes have been opened.

Pains: all factors which stop customer form completing a job are called pain, in other words pain also include negative outcomes that customer prefer to avoid such as price of the box with the new implementation, the fear of battery charging and forgetting their passwords of the box. Many studies show that high percentage of violent incidents by using weapons happens because it was easy for criminals to reach to weapons and use them against peaceful people

Gains: it's not the opposite of pains but they are aspects that encourage users to buy the box with electronic lock, which include all the positive experiences and desires that the customers want to have such as keep their weapons safe.

The value map represents the product features, functionality and benefits that attract customers and fulfil their need from the other part of value canvas.

Products and Service: this is the place to list all the feature, which the new box with lock will provide. With an electronic lock will be easy to the owner of the box to open it and lock it so many times with SD memory which record how many times the box has been opened and above new features will be add to box such as extra device will be add called master and slave where the password that entered in salve must match the password in master.

Pian relievers: here the focus is how the new product will ease the customers' pain. Experiences that the customers will have with new technology that secure and save precious goods and dangerous products such as weapons or other items that they don't want to reach to it.

Gain creators: this is where the new product adds value to customers life, High security, and advance technology will be in customers' hands which will make them happy.

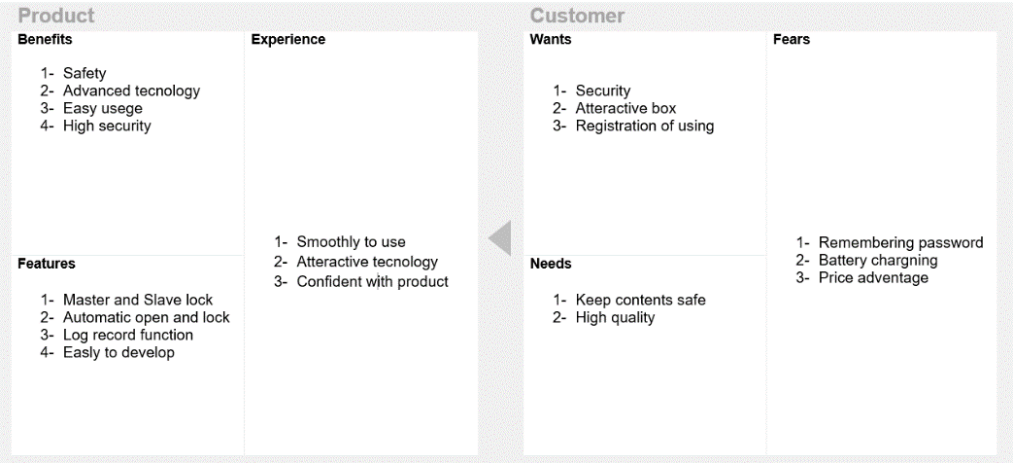

Figure 5 Value Proposition table

6. Prototype

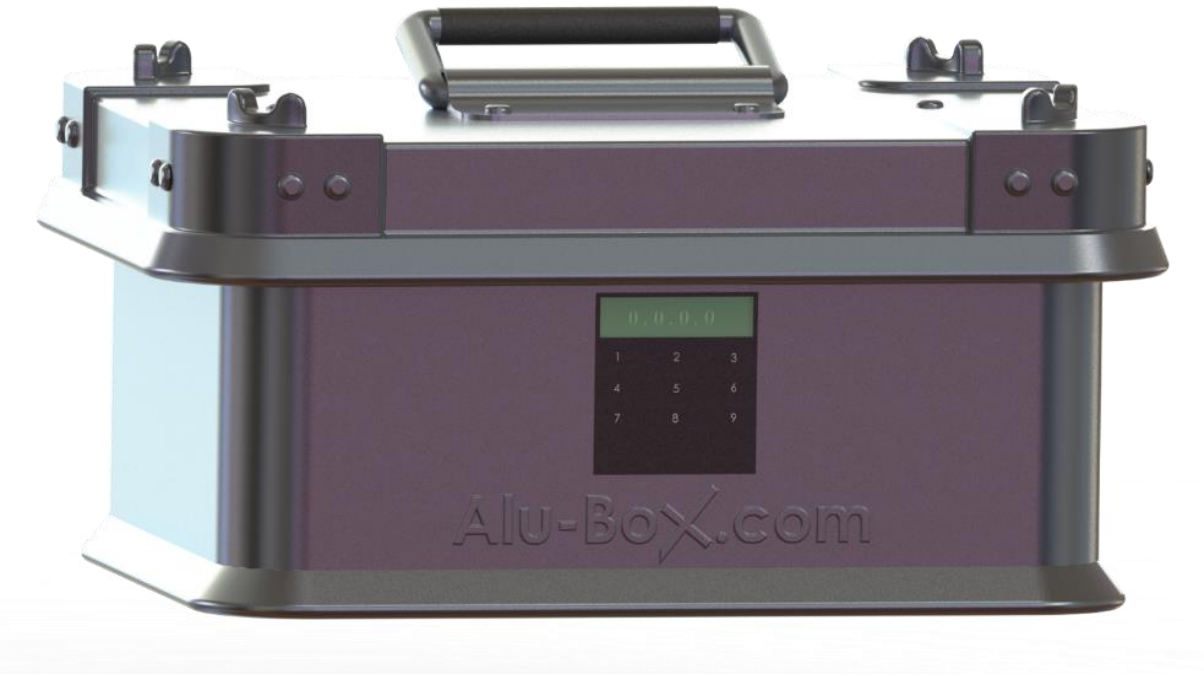

Figure 6 Prototype

6.2 Electronic lock

It is an electronic lock that has 2 parts, which we call "Master" and "Slave". The master is like a server that has an access list and that controls who has access to the electronic lock. The master can also change the code for the user. The slave opens and locks this electronic lock using a Servo Motor, which is connected to a Keypad, where the user can enter the password determined by the Master and place the card on the card reader and thus open the box.

- Actual Design:

An electronic lock that has 2 main parts and 1 lower part. The two main parts are Master (1) and Slave (1), Slave (1) is also Master (2) to another Slave (2), which is thus the lower part.

Master (1) has:

• Sensor.

• Alarm.

• Keypad.

• LCD.

• Transceiver module.

• Buzzer.

• LEDs.

• Potentiometer

Master (1) has an alarm system with a sensor, and if the alarm is activated, a password must be entered to turn it off, and then Master (1) has the option to change the code for the alarm. Master (1) can also change the code and send it to Slave (1).

Slave (1) as Master (2) has:

• Keypad.

• LCD screen.

• RTC ds3231.

• WIFI module.

• Servo Motor.

• Sensor.

• Buzzer (Alarm).

• SD card.

• LEDs.

• Potentiometer

Slave (1) gives the user access to this electronic lock if the correct code is entered, which Slave (1) receives from Master (1), and if the code is correct, the box opens. Slave (1) also has an alarm system that is connected to a sensor so that Slave (1) can activate the alarm system.

Slave (2) has:

• SD card module

• RTC ds3231.

Slave (2) has an RTC ds3231 that records the time from when this electronic lock opens and locks, and it gets this information by communicating with Slave (1) using

the charges.

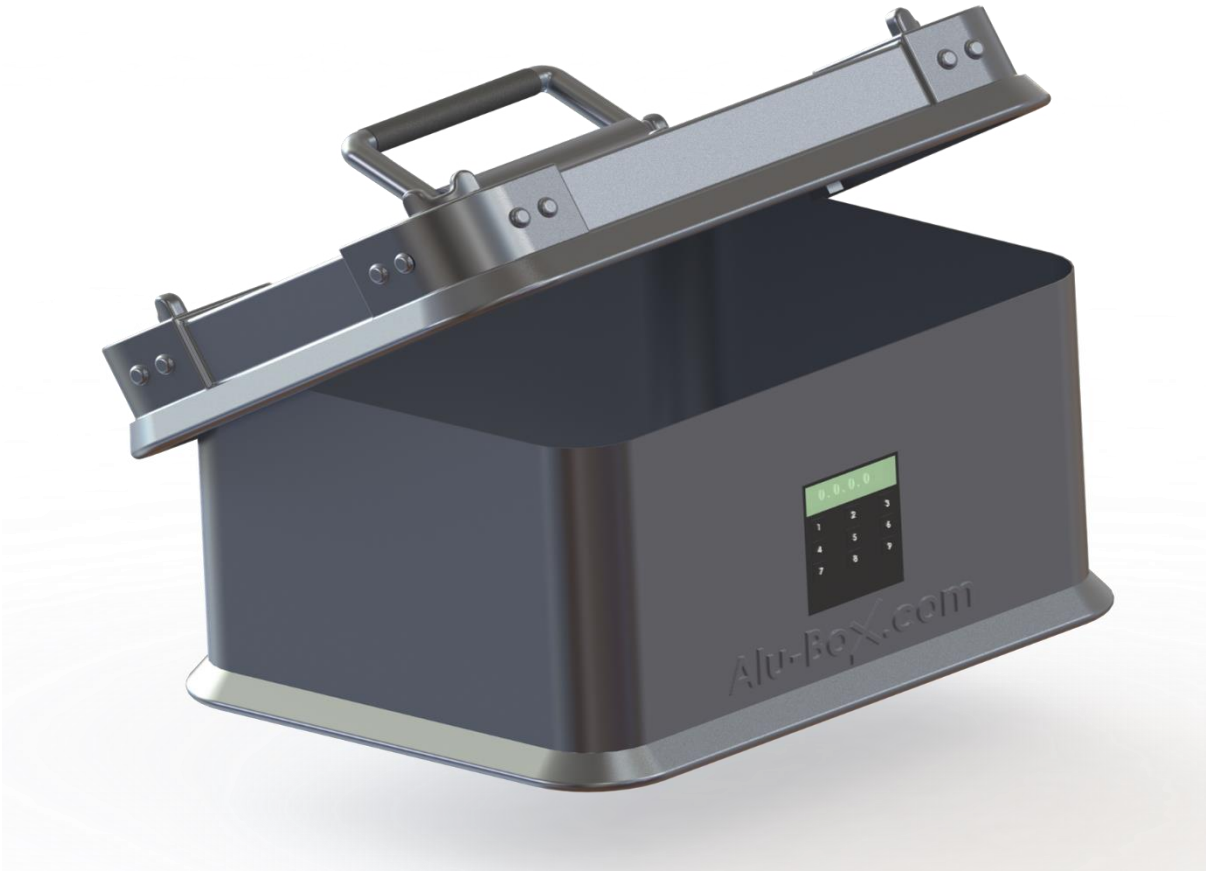

Figure 7 Prototype

7. Business and Economic perspective

7.1 List of parts

Components:

Our project has many components that are used, and they are:

1. Keypad (4x4 Matrix Membrane Keypad).
2. 16x2 LCD.
3. Potentiometer
4. NRF24L01 transceiver module.
5. Micro Servo SG90.
6. Pir Sensor.
7. RTC ds3231.
8. Buzzer (Piezo Alarm).
9. SD card module.
10. Led.

1. Keypad (4x4 Matrix Membrane Keypad):

This 16-button keyboard provides a useful "human interface component" for microcontroller projects. It has a practical adhesive backing that makes it easy to mount the keyboard in various applications, e.g., security systems, menu selection and data entry for embedded systems.

Figure 8 Keypad

2. 16x2 LCD:

16x2 LCDs are highly functional, low-cost liquid crystal displays that can be easily interfaced and controlled by a microcontroller. LCD monitors provide basic text wrapping so that one's text appears correctly on the screen. Full control of all their advanced LCD functions allows you to move the cursor anywhere on the screen with a single instruction and turn the display on and off in any configuration, plus you can define up to eight of your own custom characters that should be displayed anywhere on the LCD screen.

Figure 9 LCD display

3. Potentiometer

A potentiometer is a resistor that has a mechanical screw that can be turned to change its resistance

Figure 10 Potentiometer

4. NRF24L01 transceiver module.

If you have two or more Arduino boards, then you can get wireless communication with them over a distance, and this opens up lots of possibilities such as remote monitoring of sensor data, control of robots, home automation, etc. It is possible to do using an NRF24L01 which is easy to find and has low cost.

Figure 11 Transceiver module

5. Micro Servo SG90:

Micro Servo Motor SG90 is a small and light server motor with high output power. Servo can rotate approximately 180 degrees (90 in each direction) and can work like Servo motors. One can use any servo code, hardware or library to control these servos.

Figure 12 Micro Servo Motor SG90

6. PIR Sensor (HC-SR501):

A PIR or passive infrared sensor can be used to detect the presence of people in its vicinity. The output can, for example, be used to control the movement of a door. ... A PIR sensor detects the infrared light emitted by a hot object.

A PIR sensor provides an opportunity to sense movement and is almost always used to register whether a person has moved into or out of the sensor's range.

Figure 13 PIR Sensor

7. RTC ds3231:

The DS3231 is an extremely accurate low-cost I2C real-time clock (RTC). The unit has a battery input and maintains accurate timing when the main power to the unit is interrupted. It maintains information about seconds, minutes, hours, day, date, month and year.

Figure 14 RTC ds3231

8. Buzzer (Piezo Alarm): It is a small speaker that you can connect directly to an Arduino

Figure 15 Buzzer (Piezo Alarm)

9. SD Card module: The SD card module is useful for projects that require data logging

Figure 16 SD Card module

10. Led

Figure 17 LED pær

7.2 Budget (1) piece

Inventory List

Dit firmanavn gruppe 12
Adresse Lautrupvang 15
By, postnummer 2750 Ballerup
Telefon 71381132
Mail s180424@dtu.dk

Dato 19-08-2022

Faktureres til: Alu-Box
Alubox.com
Nyrupvej 70
DK – 4180 Sorø
Tlf: +45 57 60 10 02
Email: info@alubox.com

Disciption	Number of pieces	Price (DKK)	
Keypad (4x4 Matrix Membrane Keypad)	1	kr.	60,00
16x2 LCD	1	kr.	30,00
Potentiometer	2	kr.	10,00
NRF24L01 transceiver module	2	kr.	100,00
Micro Servo SG90	1	kr.	20,00
Pir Sensor	2	kr.	44,00
RTC ds3231	1	kr.	15,00
Buzzer (Piezo Alarm)	2	kr.	22,00
SD card module	1	kr.	19,00
Led	4	kr.	8,00
Arduino Microcontroller	1	kr.	207,00
	I alt 18	kr.	535,00

Tabel 1 List of materials

8. Further perspectives

The next step is the ALUBOX must implement an IoT APP to control the electronic lock so that customers can easily open and lock the box using the IOT APP on their smart phones or smartwatch

The main reason of this step is so important for the company's development because, the Internet of things has converted the rate with which we really act with devices. In recent years, there were about 6 billion lOT devices being used, but it is not just consumers using them. the entire world, from organizations to governments and companies is looking in lOT to simplify processes and change productivity in newer ways.

This is how the Internet of Things works, firstly scans the local system searching for Pi. Once this Pi is seen you configure this app with its IP code. So, the only thing left to do is to use simple API calls that can be performed on microcontroller on each activity like set the lock or set it off. It is important to first understand at least one fundamental aspect of mobile app development before deciding what type of mobile program to improve. Development of mobile apps is the process by which mobile applications are developed for mobile devices. Because of the rapid changes in moving code and modifications within each platform, it is important to consider the mass of screen sizes, hardware specifications, and configurations.

The benefits which the customer and company will get of design this app is an easy effective method to lock the box and unlock it only by one click on the button on customer's mobile. This in itself is something that makes the product more attractive to the customer and adds ease and effectiveness to the customers when using the box and fulfils the customer's requirements by providing seamless technology to the customer in addition to being compatible with modern technology .furthermore by using this APP help to reduce the hardware of the locks circuit (remove the KEYPAD) and at the same time the cost of productive the hardware decrease, moreover, will help to minimize the size of the lock inside the box Which correspond to also less space for the lock and make it easy to implement and setup in the box on terms of production and manufacturing side

IOT APP will also over for the customer a new function calls find my box this function has a motion to find out the box location in case if the box has been stolen or missing.

This function will make the box an ideal product for the customer and satisfies the customer's desire for a product that is safe and protected from theft and loss similarly building great trust between the consumer and the company's product.

As a last point, this app can be considered a foundation for developing the box in the future and adding more features, services, and functions to the product with more low costing.

In the following figure, an initial image of the application shows the interface of the application that the customer will deal with.

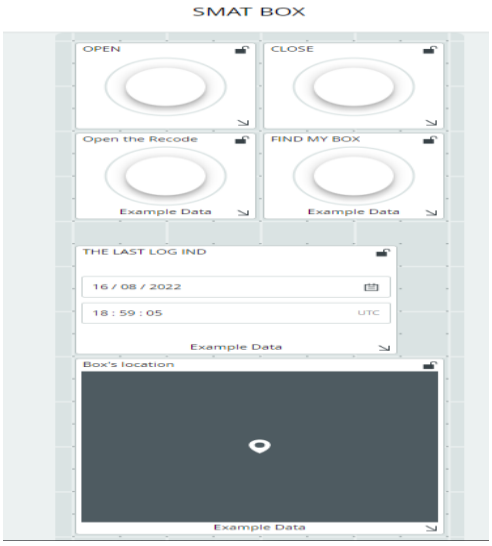

Figure 18 interface of the application

In the figure above shows the user interfaces, the open box button, and the close button, in addition to the "Where is my box" function button, which, when pressed, displays the coordinates of the box's location on the Google Map, furthermore there is the button which has a function to open the record logs, which will open a window shows a CSV file that contains the open and close record for the box

9. Conclusion

It can be concluded that electronic lock will affect that segment group's user experience positively, since the design of this lock is based in data collected from users. Furthermore, a target audience analysis and different models have been made gave us insight into which needs had to be met and the strategy and design to be used.

From this we used the value proposition method to determine the essential values of electronic lock appropriates the user. When it comes to modernising the additional lock, we included new shapes such as the master and slave keypad that will give user more security to their valuable items.

Here the product moves away from the standardised form such as normal lock as well as traditional look to more technology that will be useful to include in the design since number of accidents is increased in the last years.

Which everyone is familiar with additional way of lock systems. The new design will give user more safety. As far as the sustainable initiatives are concerned, we focused on the end shape. Which means that sustainable measures are implemented when the electronic lock is to be further develop over the years.

A Price determination has also been prepared based on the price of the various sub-components that are included in the final solution. But since the actual production information is difficult to access, we started from approximate prices when it came to investing is production parts, that must deliver the desired frame shape. In the end and with 20% set on top of the production costs, the company can produce one electronic lock between 300 to 500 DKK.

10. Work distribution

Studnet	Abstract	Introduction to Business Plan	Problem statement	proposal and the reason for it	Business Analyse	Prototype	Business and Economic perspective	Further perspectives	Conclusion
Ahmed	20	10	10	20	19	10	14	20	10
Bashar	20	10	20	13	15	20	14	16	10
Jussef	10	20	10	7	15	10	14	18	10
Malaz	20	20	20	20	17	30	25	14	20
Mohamad	20	20	15	20	17	20	20	20	20
Zakaria	10	20	25	20	17	10	13	12	30
Total	100	100	100	100	100	100	100	100	100

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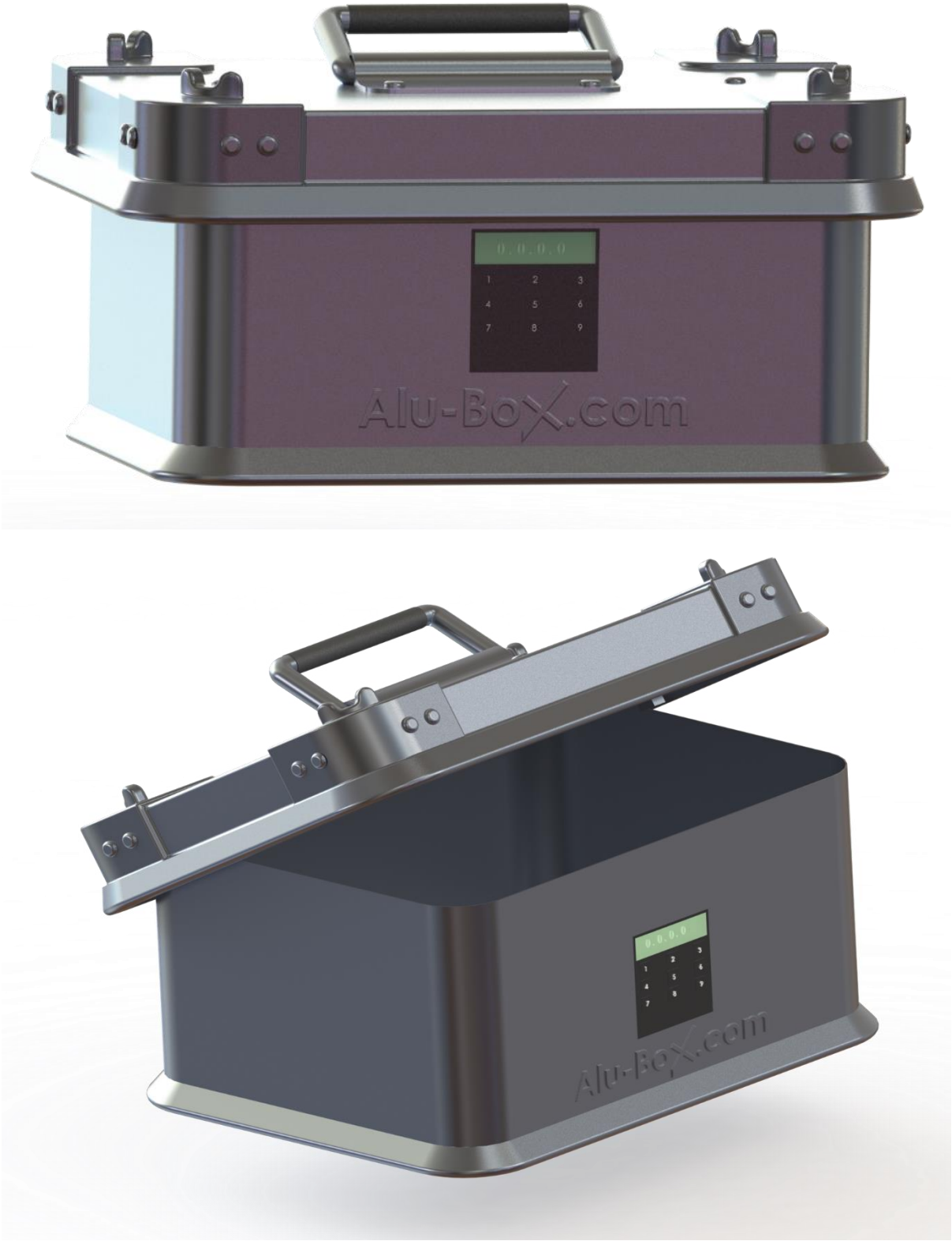
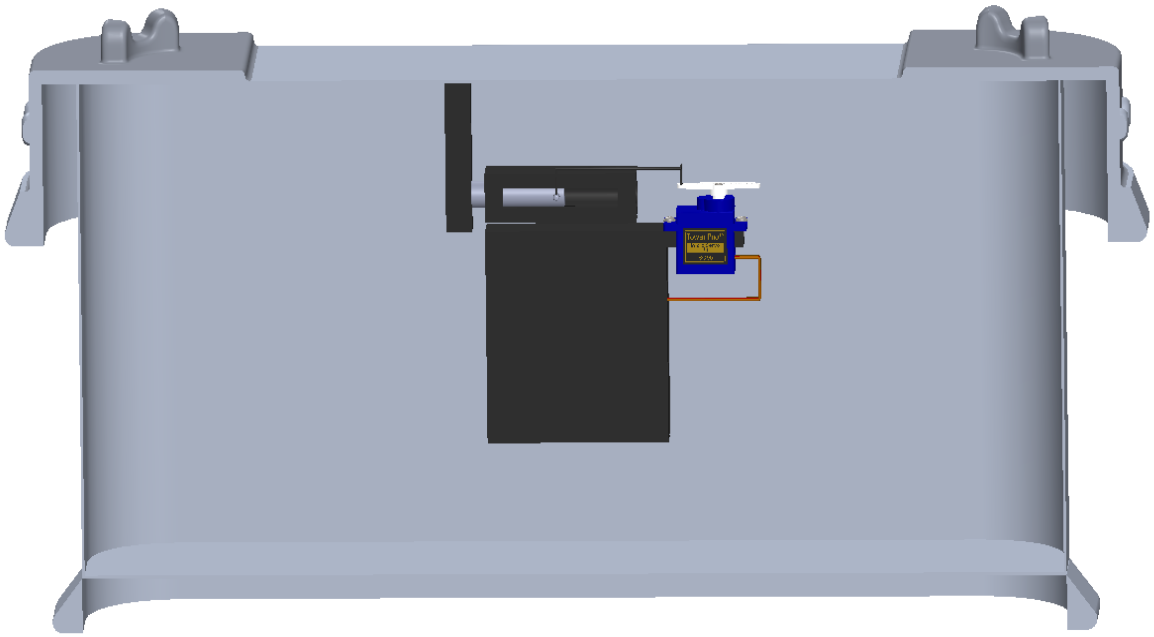
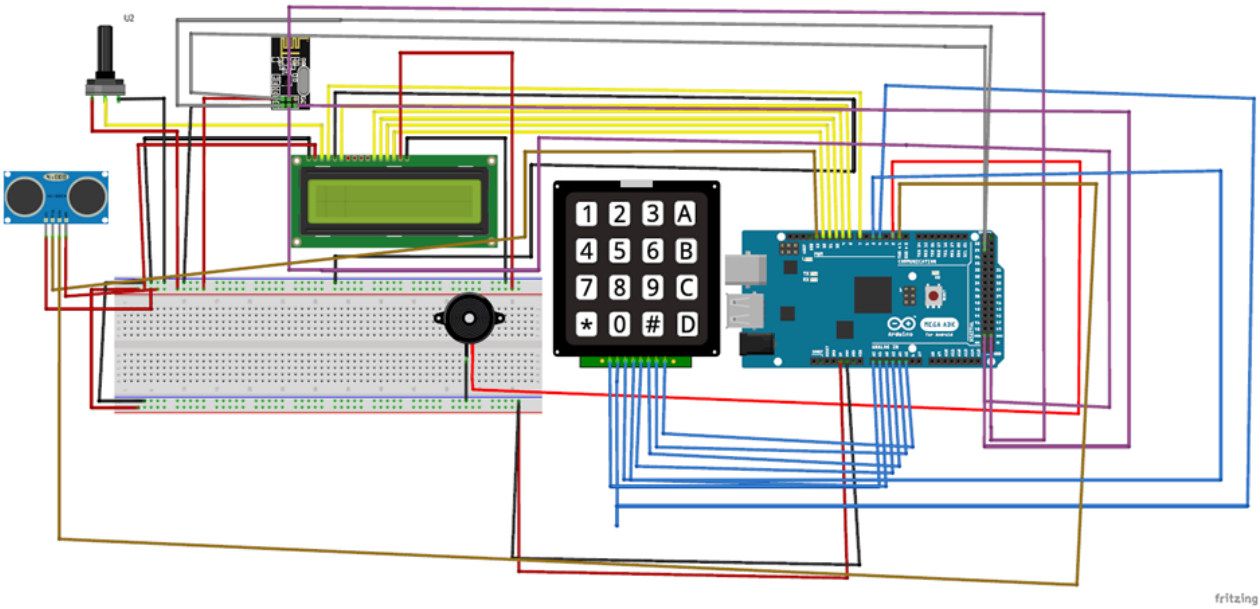
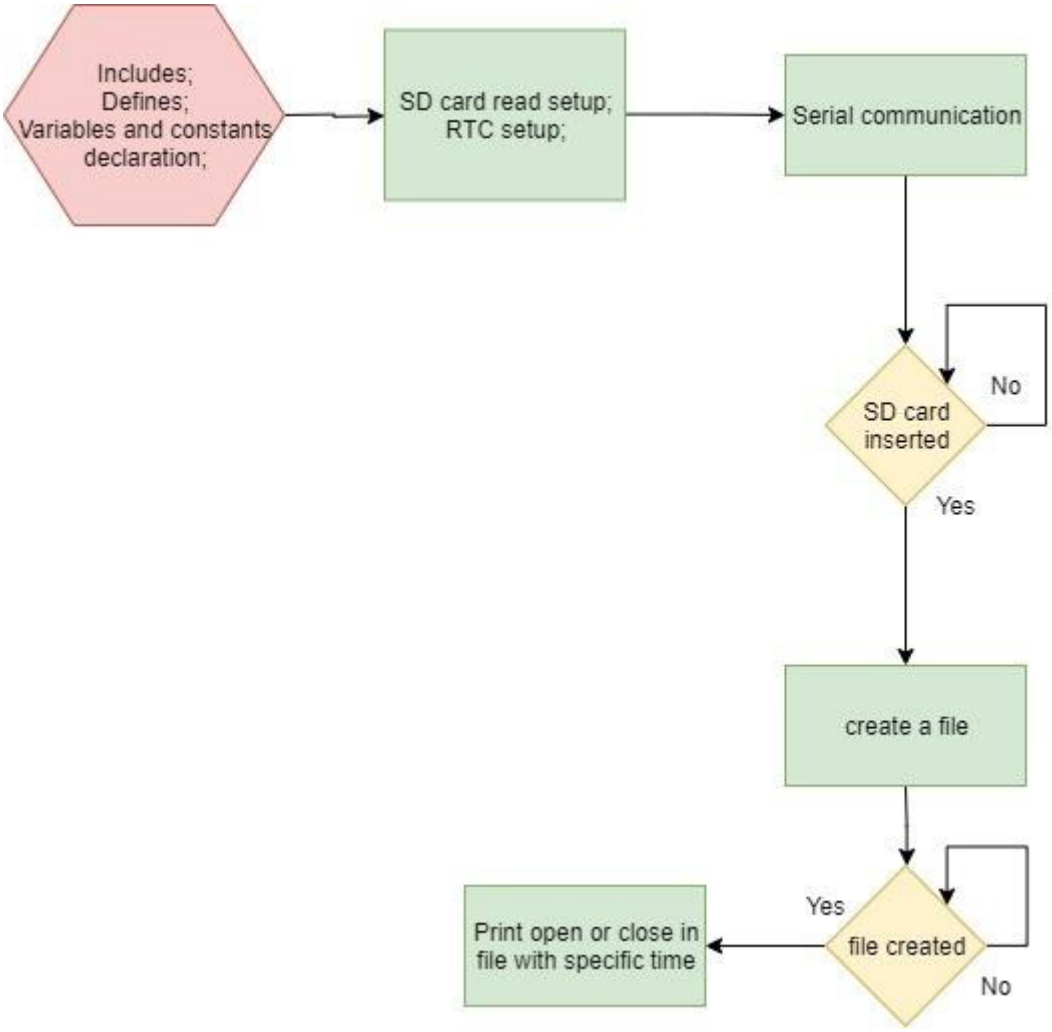
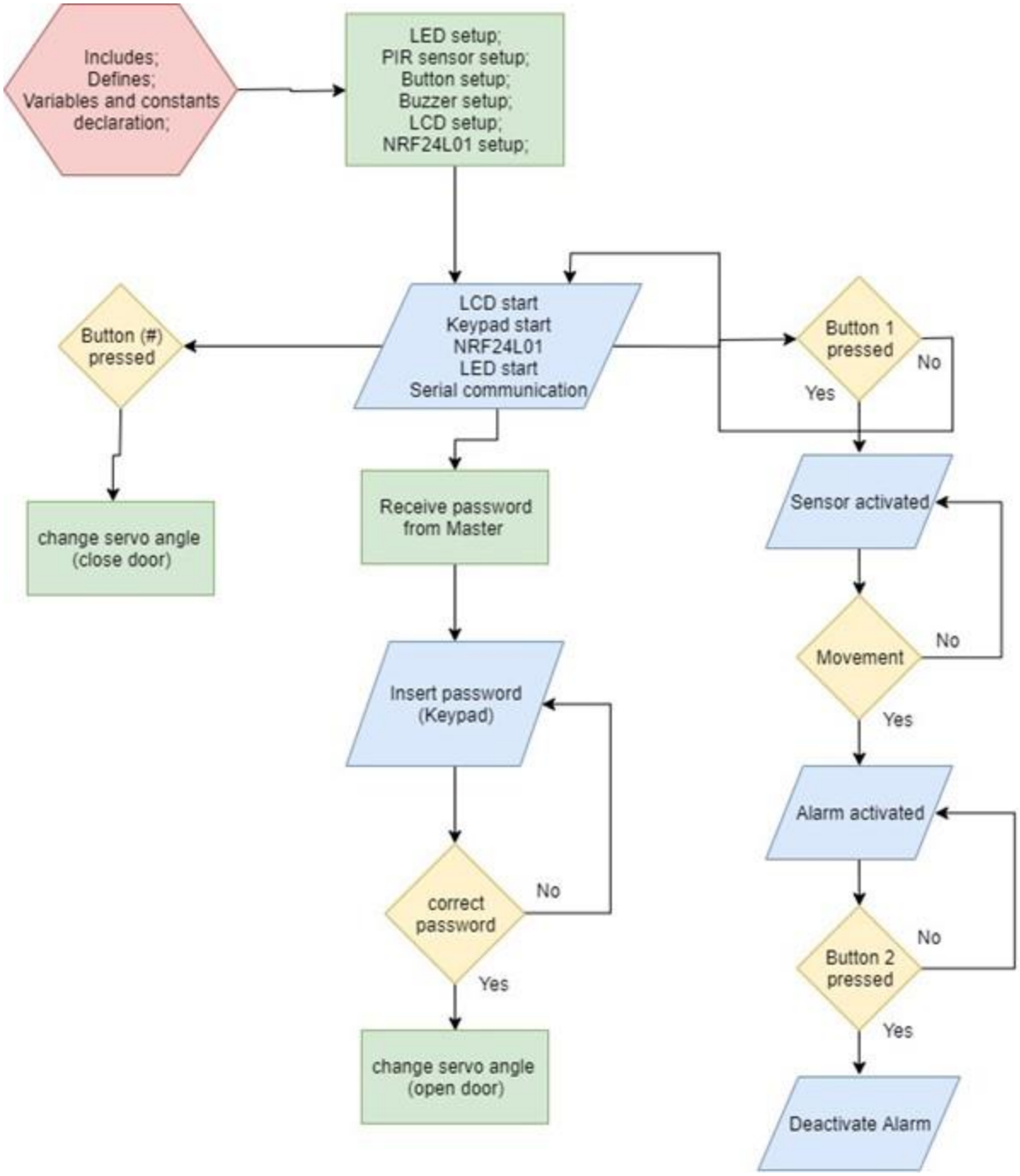
Appendix

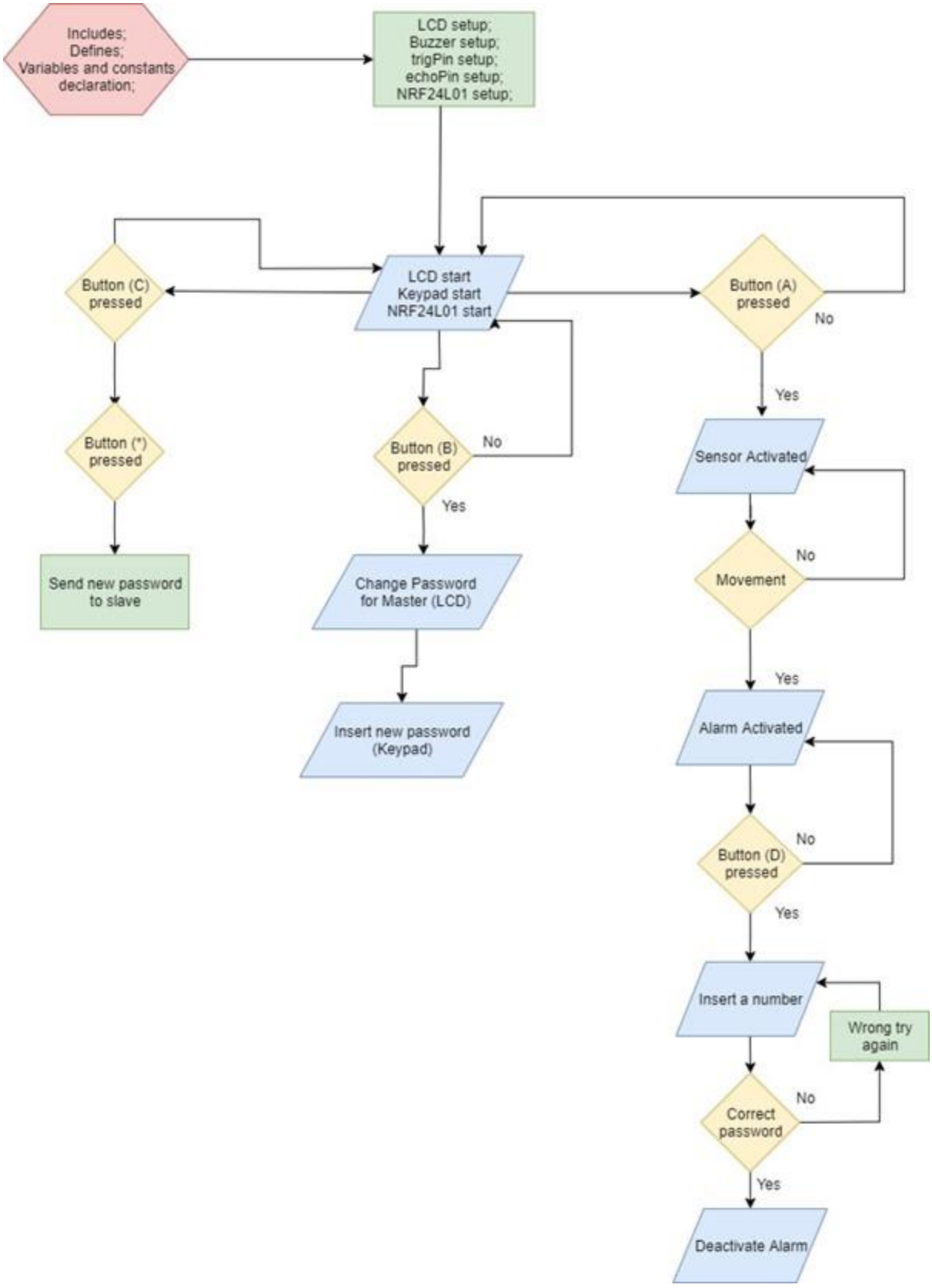


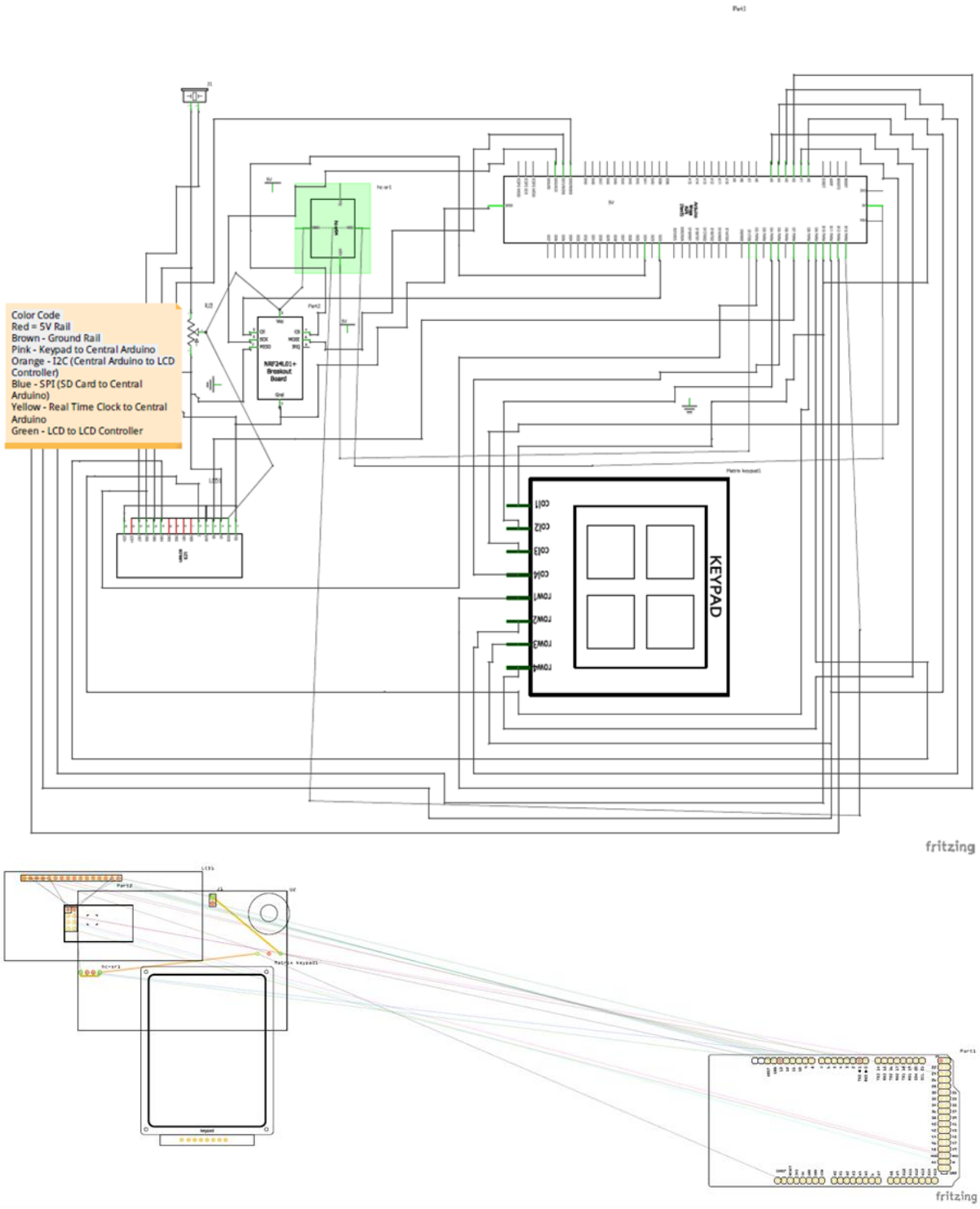


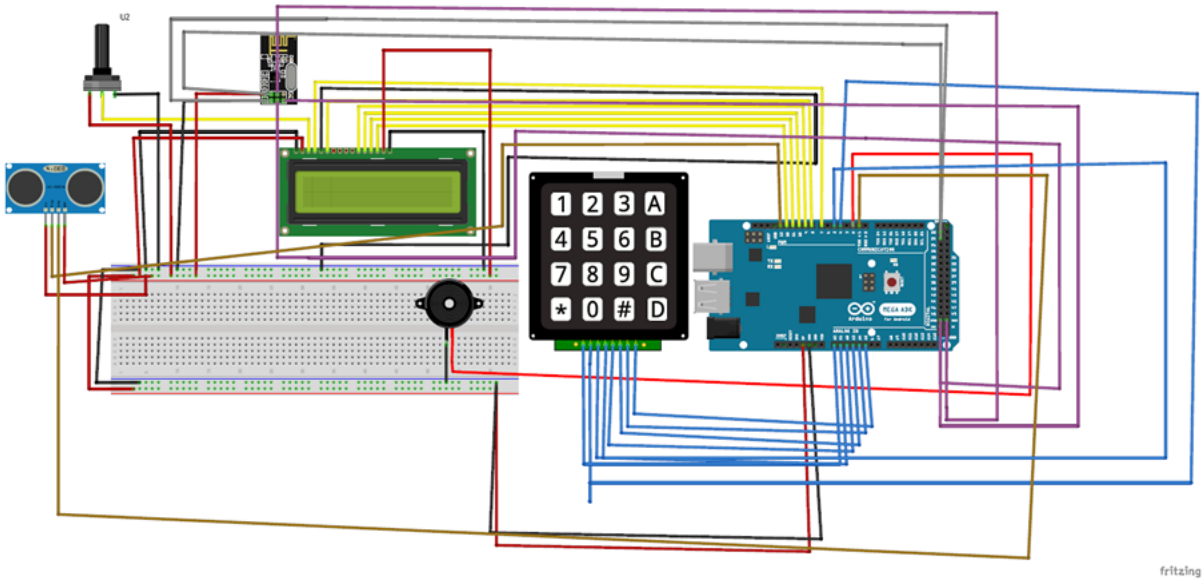

1 2 3 A
4 5 6 B
7 8 9 C
* 0 # D
fritzing

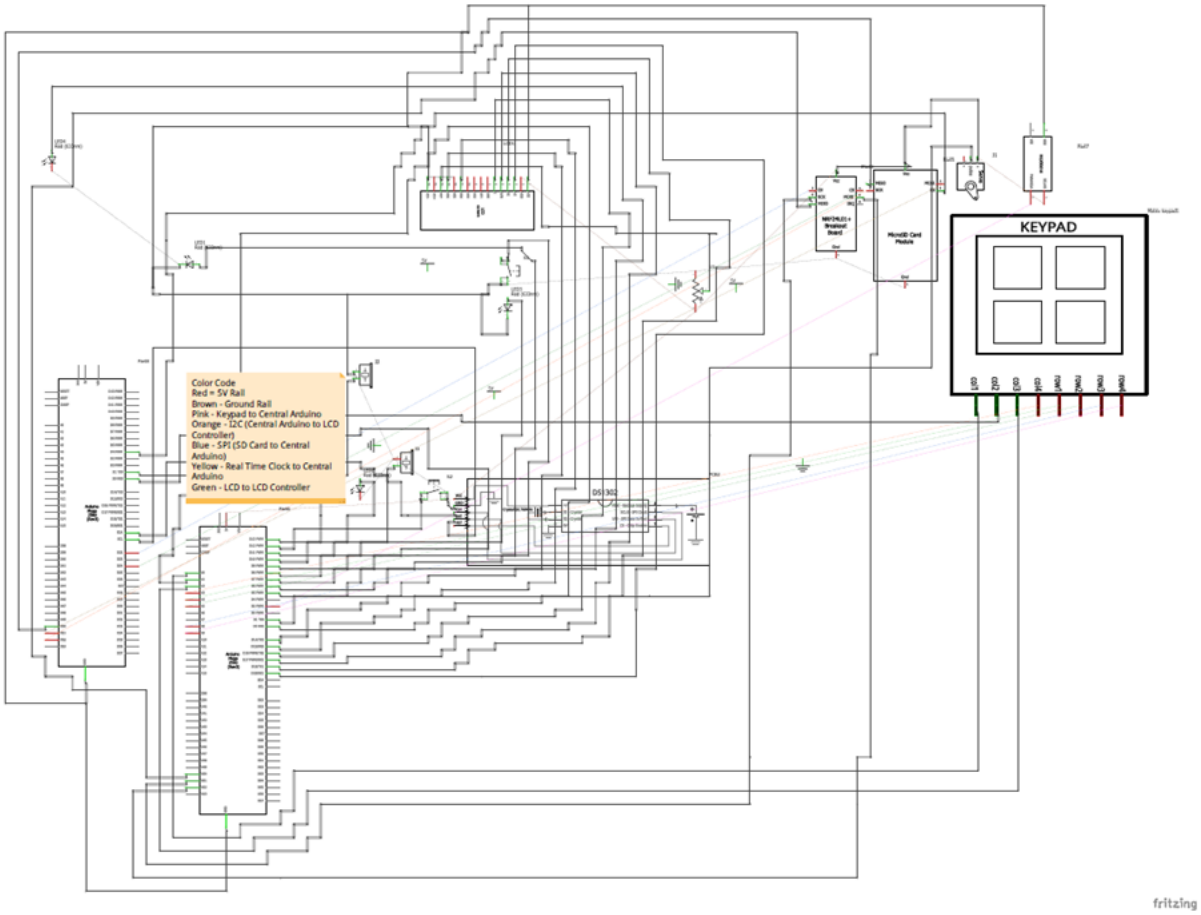

Includes;
Defines;
Variables and constants declaration;
SD card read setup;
RTC setup;
Serial communication
SD card inserted
No
Yes
create a file
file created
Yes
No
Print open or close in file with specific time


Includes;
Defines;
Variables and constants declaration;
LED setup;
PIR sensor setup;
Button setup;
Buzzer setup;
LCD setup;
NRF24L01 setup;
LCD start
Keypad start
NRF24L01
LED start
Serial communication
Button (#) pressed
change servo angle (close door)
Receive password from Master
Insert password (Keypad)
correct password
No
Yes
change servo angle (open door)
Button 1 pressed
No
Yes
Sensor activated
Movement
No
Yes
Alarm activated
Button 2 pressed
No
Yes
Deactivate Alarm


Includes;
Defines;
Variables and constants declaration;
LCD setup;
Buzzer setup;
trigPin setup;
echoPin setup;
NRF24L01 setup;
LCD start
Keypad start
NRF24L01 start
Button (C) pressed
Button (*) pressed
Send new password to slave
Button (B) pressed
No
Yes
Change Password for Master (LCD)
Insert new password (Keypad)
Button (A) pressed
No
Yes
Sensor Activated
Movement
No
Yes
Alarm Activated
Button (D) pressed
No
Yes
Insert a number
Wrong try again
Correct password
No
Yes
Deactivate Alarm


Color Code
Red = 5V Rail
Brown - Ground Rail
Pink - Keypad to Central Arduino
Orange - I2C (Central Arduino to LCD Controller)
Blue - SPI (SD Card to Central Arduino)
Yellow - Real Time Clock to Central Arduino
Green - LCD to LCD Controller
KEYPAD
fritzing
fritzing


1 2 3 A
4 5 6 B
7 8 9 C
* 0 # D
fritzing


KEYPAD
Color Code
Red = 5V Rail
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Pink - Keypad to Central Arduino
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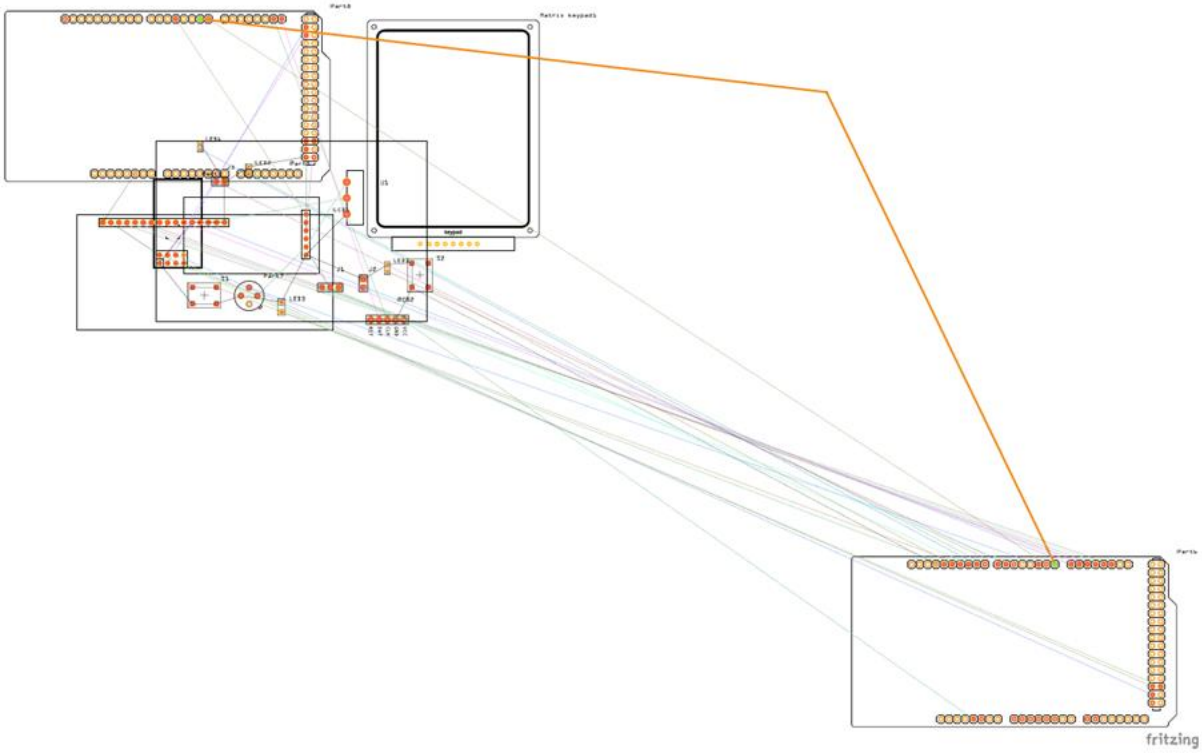
fritzing


fritzing