I. Background

This chapter presents the definition of the problem, scope of the problem, different solutions related to the problem and why this solution is chosen.

A. The MediColBox

the MediColBox is the medicine colletion part of Medretur's solution for collecting medicine in an effort to prevent medicinal waste and damage.

the MediColBox is a box made by 8 mm thick aluminium plates. It is 600 by 600 mm wide and 600 mm high. On the side of it is a removable cart held together with internal locking mechanisms in steel designed to not pose a weak point on the box.

On top of this box is bolted tight a wedge shaped lid, also 600 by 600 mm wide. The wedge shaped lid is 600 mm high on the tallest section and 200 mm high on the lowest section. on top of the lid is a touch screen posing as the HMI and an opening designed to allow you to insert some medications for internal mechanisms to sort.

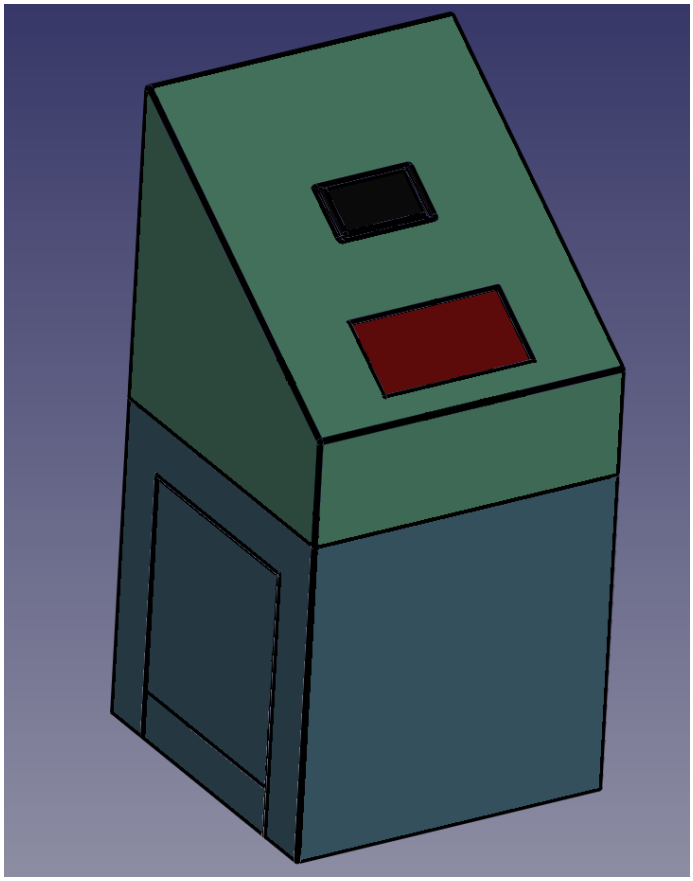

Fig. 1. render of the MediColBox from before it was built

The total weight of the MediColBox is 86 kg and the aluminium casing has been tested to sustain repeated impacts with an estimated force of 8000 N(this has been meassured using an internal accelerometer, meassuring the maximum total acceleration registered during the impact and multiplying that acceleration with the mass of 86 kg.)

B. Definition of the problem

The problem is intrusion, but is what is intrusion? According to Merriam-Webster, an online English dictionary, intrusion is a noun and is defined in this context as:

"the act of intruding or the state of being intruded" [**?**]

especially:

"the act of wrongfully entering upon, seizing, or taking possession of the property of another" [**?**]

In the context of the MediColBox, the word "intrusion" refers to attempts on breaking collection system in an effort to gain access to the disposed medicines stored inside. The MediColBox contains medications that are expired or no longer needed, which can pose a danger to individuals if they are not disposed of properly [**?**].

The improper disposal of medications can lead to environmental contamination, harm to human health, and the potential for misuse.

The black market for medications also presents a criminal incentive to break into the collection system and steal the medications for resale. Additionally, there are individuals who may be addicted to certain medications and would seek to gain access to them for personal use.

Therefore, it is crucial to ensure that the MediColBox is secured and protected from intrusion attempts to prevent the tampering or theft of medications.

This requires the implementation of effective detection and deterrent measures to identify and stop intrusion attempts in real-time.

To intrude into the MediColBox in an attempt to get access to the medicines inside, it will be necessary to get through the outer metal shell. The metal

shell, in this context, is a type of mechanical barrier, separating the outside from the inside.

Most types of intrusion attempts can be simplified to the contents of (Table I).

TABLE I
TYPES OF INTRUSION ATTEMPTS

Intrusion Attempt	Description
Cutting through the shell	This type of intrusion attempt involves using tools such as saws or angle grinders to physically cut through the outer metal shell of the MediColBox. It is a relatively straightforward method that can be quickly executed if the intruder has the necessary tools and equipment.
Forcing apart the shell	Forcing apart the shell refers to attempts to pry open or force the outer metal shell of the MediColBox using tools such as pry bars or similar implements. This method relies on applying excessive force to overcome the locking mechanisms in the shell and gain unauthorized access.
Exploiting the shell	Intruders may attempt to unlock the shell using various exploits, such as lock picking tools, brute force attacks, or electronic hacking techniques. These methods involve manipulating the lock or electronic components of the shell's locking mechanism to gain access without proper authorization.

Cutting through or forcing apart the outer metal shell of the MediColBox are relevant intrusion attempts because they can potentially compromise the security of the contents inside, which are the expired or unused medications. Unauthorized access to these medications can pose a serious risk to public health and safety, as they may be misused, abused, or sold illegally.

Cutting through the shell can be done using power tools such as saws or angle grinders, while forcing apart the shell can be done using a pry bar or a similar tool. These methods of intrusion are relatively easy to carry out and can be completed quickly, especially if the intruder has the necessary tools and equipment.

To prevent cutting or forcing open the shell, physical barriers can be implemented. These can include tamper-proof screws or bolts, reinforced steel plates, or alarm systems. Tamper-proof screws or bolts can be used to secure the outer shell, making it difficult for intruders to unscrew or remove them. Reinforced steel plates can be placed over the shell to increase its strength and make it more difficult to cut or force apart. Alarm systems can be used to alert authorities and deter intruders from attempting to break into the MediColBox.

In addition to physical barriers, other security measures can be employed to prevent intrusion attempts. These can include access control systems such as key card readers or biometric scanners, security cameras to monitor the area around the MediColBox, and regular security patrols or checks.

It is important to note that no security measure is completely foolproof, and determined intruders may still be able to find ways to breach the security of the MediColBox. However, by implementing a combination of physical and electronic security measures, the risk of intrusion can be significantly reduced, and the contents of the MediColBox can be better protected.

Exploit-based intrusion attempts on the MediColBox could involve attempts to bypass or manipulate the locking mechanisms in order to gain unauthorized access to the contents inside. These exploit could include using lock picking tools, "brute force attacks", or electronic hacking techniques.

Lock picking tools are designed to manipulate the internal workings of locks in order to unlock them without using the key. Brute force attacks involve attempting to force the lock by applying excessive force, such as hitting or kicking the lock or using a tool to pry it open. Electronic hacking techniques may involve attempting to manipulate the electronic components of the lock, such as by intercepting signals sent between the lock and its control system or by exploiting vulnerabilities in the lock's firmware or software.

Exploit-based intrusion attempts are difficult to detect and prevent because they may not leave physical evidence and may not trigger alarms or other security measures. In addition, these types of attacks may be carried out by individuals with specialized knowledge or equipment, making them more difficult to defend against.

The potential consequences of an exploit-based intrusion attempt on the MediColBox could include unauthorized access to the expired or unused medications inside, which could lead to harm to individuals who consume or misuse them. In addition, successful exploitation of the MediColBox's security measures could compromise the overall security of the system, potentially leading to further unauthorized access or theft of medications.

To prevent exploit-based intrusion attempts, it is important to implement strong physical and electronic security measures, as well as regular monitoring and maintenance of the security systems. This

can include using tamper-proof locks and security cameras, implementing access control systems with strong authentication mechanisms, and regularly updating the firmware and software of the locking mechanisms to address any known vulnerabilities. It is also important to regularly review and update security policies and procedures to ensure that they are up-to-date and effective in addressing new threats and risks.

the last point in the list implies there is something unpredicted and unplanned, so this project will recommend this for future studies instead of covering it in this study.

the project will therefore focus on detecting and deterring cutting and forcing open the shell.

There are several detection and deterrence methods that can be used to prevent cutting and forcing open the shell of the MediColBox as specified (Table II).

TABLE II
POTENTIAL SECURITY MEASURES FOR MEDICOLBOX

Security Measure	**Description**
Physical Barriers	As mentioned earlier, physical barriers such as tamper-proof screws, reinforced steel plates, or alarm systems can be used to prevent unauthorized access to the MediColBox. These barriers can deter intruders from attempting to break into the box and can also alert authorities to any intrusion attempts.
Inertial Measurements	Utilizing an Inertial Measurement Unit (IMU) in the sensor card to detect any changes in the box's orientation or movement, providing additional data for intrusion detection and prevention.
Motion Sensors	Motion sensors can be placed around the MediColBox to detect any movement or activity in the surrounding area. If an intruder attempts to cut or force open the shell, the motion sensors will detect their movement and trigger an alarm, alerting authorities to the intrusion attempt.
Video Surveillance	Video cameras can be installed around the MediColBox to monitor any activity in the surrounding area. The footage can be monitored in real-time by security personnel, who can alert authorities to any intrusion attempts.
Smart Locks	Smart locks can be used to secure the MediColBox, using electronic authentication mechanisms such as biometric scanners, keycard readers, or passwords. These locks can be integrated with other security measures, such as motion sensors or video surveillance, to provide additional layers of security.
GPS Tracking	GPS tracking technology can be used to monitor the location of the MediColBox and track any unauthorized movement or tampering. This can help to deter theft or unauthorized access to the box.

Existing technologies that can be adapted for use in the MediColBox include tamper-proof screws or bolts, reinforced steel plates, alarm systems, motion sensors, video cameras, smart locks, and GPS tracking devices. These technologies can be integrated into the overall system by connecting them to a central control system or security platform, which can monitor and manage the various security measures in real-time.

Overall, by implementing a combination of physical and electronic security measures, the risk of cutting and forcing open the shell of the MediColBox can be significantly reduced, and the contents of the box can be better protected.