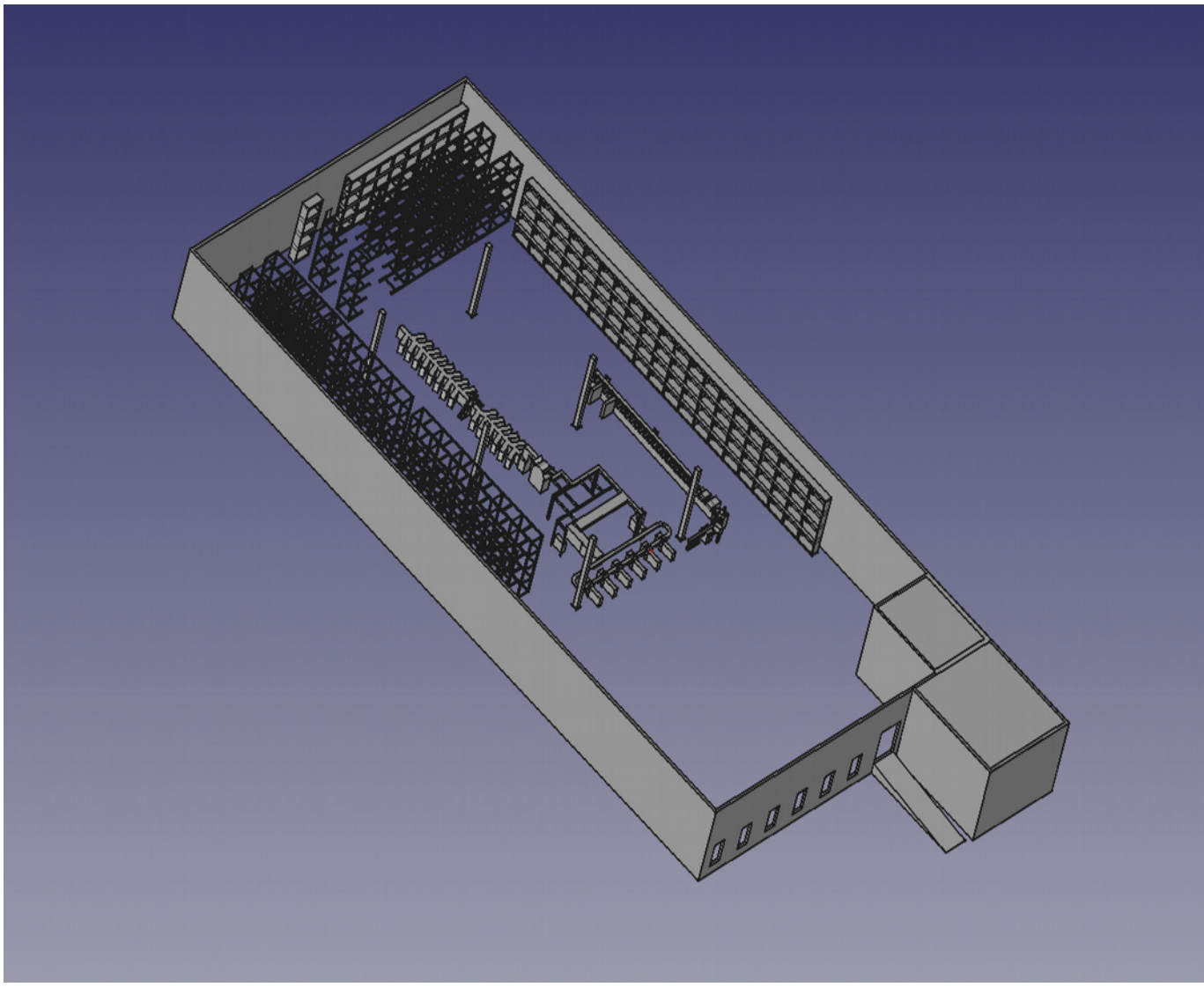

« Study of a System of sensors on a machine FERAG for real time dis key performance indicators »

Promotion CI 2018

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Summar

First, and before I present my work, I would like to thank Everyone who has helped with this work directly or indirectly.

I would like to thank everybody at the offices of AD PROD in Sorgues that welcomed me with open arms all three months of the internship.

The team helped me to discover the world of the office and team work and the constraints of development and organizations.

First and formost, I want to present my sencere gratatude to Eric ROUX, Responsable in the R&D division of AD PROD and my mentor, to NACER SIMOHAMMED Director of the site of Sorgue, to Mr Phillipe Branger, the President of ADREXO the parent company of AD PROD, for their guidance, advice, experience and information.

I would also like the technicians in Ad prod and the operator and staff for their help and advice that facilitated the workload tremendously.

Abstract:

During my internship I worked on 4 projects, the first was a way of getting the net and mean cadence of the machine Ferag, for the first weeks I came up with 4 solutions, and while I was waiting for the validation of one of the solution, I second project was presented to me by the director of the Sorgues site. The project has a goal of helping the operators with the work load, and protect their health. I finished this in 3 weeks and presented it to the management. During this time I worked sometimes on the ADREXO table to replace the machine in case of the machine breaking down, I focused on this part after the hoist project has finished. Finally in the last month I worked on the KPI extensively and carried tests and improvement to leave the best solution possible.

Introduction:

Machines are complicated pieces mechanical and electronic engineering, companies which buy and operate large scale machines are burdened by excessive costs of development and are constrained by the makers of the machines.

Machine makers, in order to make more money, offer basic information with the first sale. A more rich and useful is exploitations of the harder is usually presented at exuberant prices. Companies have the choice between paying Substantial amounts of money to the machine makers or develop monitoring systems to offer the same information.

Another Problem facing companies, especially the one which work in targeted advertising, is down time of the machine because of the maintenance or other issues. A back up less automated system needs to be created. The process is largely done by humans, the result should have the same quality as the automated one.

four projects ware discussed in detail in the following paper. The first is a Hoist which is a system that helps workers pick up the product to place it on the palettes. The second project was installing a system that gives the net and brut cadence of the production line. The third projects were the design of a Manuel agronomic table for manual production. The fourth and last project consists of a constructing a TRS.

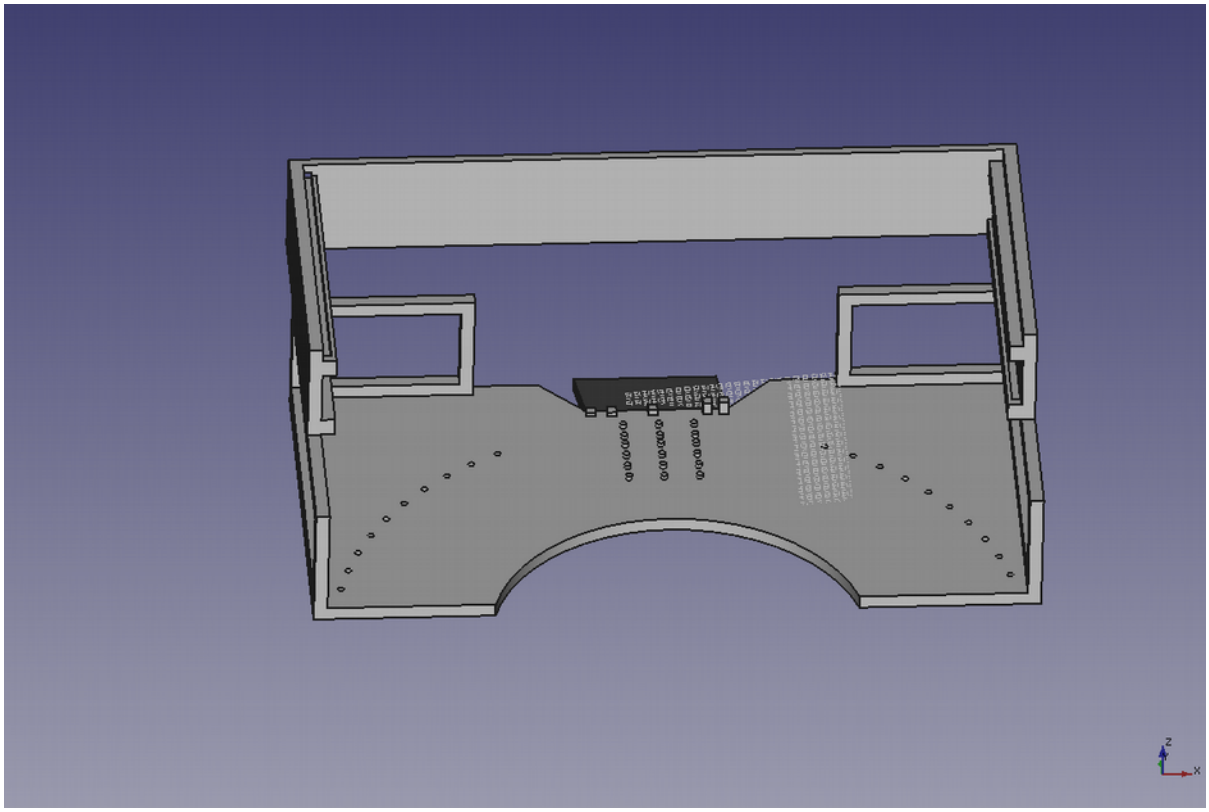


Figure 1: ADREXO Table.

Companies in France use targeted publicity to grow their market. Batches of publicity flyers are used, they are put in mail boxes of specific areas. These batches are constructed mostly by machines.

ADREXO is the second biggest player in the targeted advertising business in France, the company has three sites; Gare, korban and Surges.in the three sites they have machines made by FERAG which is a swiss German organization that makes machines in the printing domain.

Adrexo is a company of around 38 years old, it employees are around 11000 workers. It's head quarter is in AIX EN PROVIANCE. The company's main activity didn't change throughout the years, it's mainly publicity and marketing.

The company was recently merged with its branches to become a new company called HOPPS.

Figure 2:Adrexo logo.

Figure 3:Hopps logo

1. Hoist

1. Context:

The machine FERAG puts out packets that contain batches of flyers which are destined to a specific area, these packets are transported in pallets using trucks to be distributed all around the country. Operators of the PKT are forced to carry packets of 5/7kg hundreds of times a day, in total one operator carries around 3 tons of packets every shift. The movements required to well position the packets inside the pallets are not ergonomic and may cause injuries.

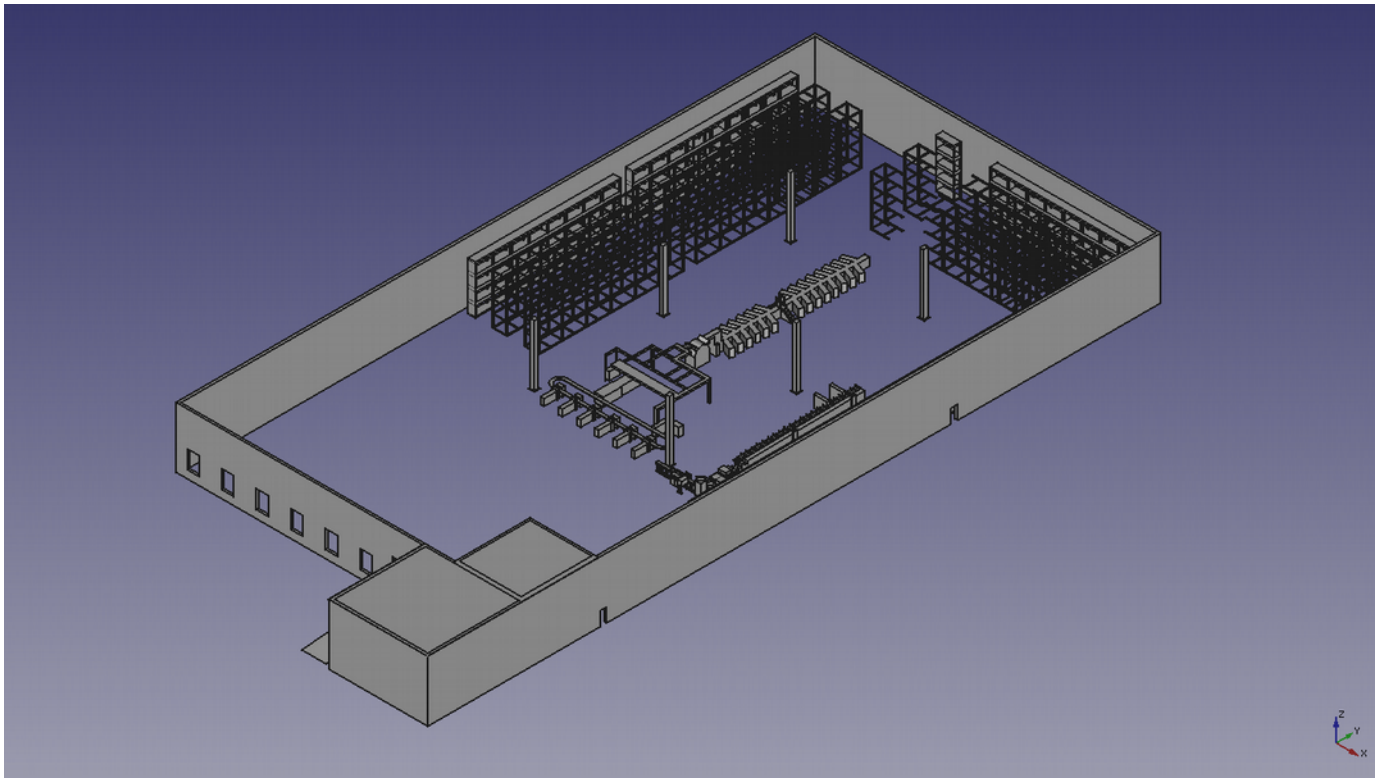


Figure 4: the machine FERAG inside the factory.

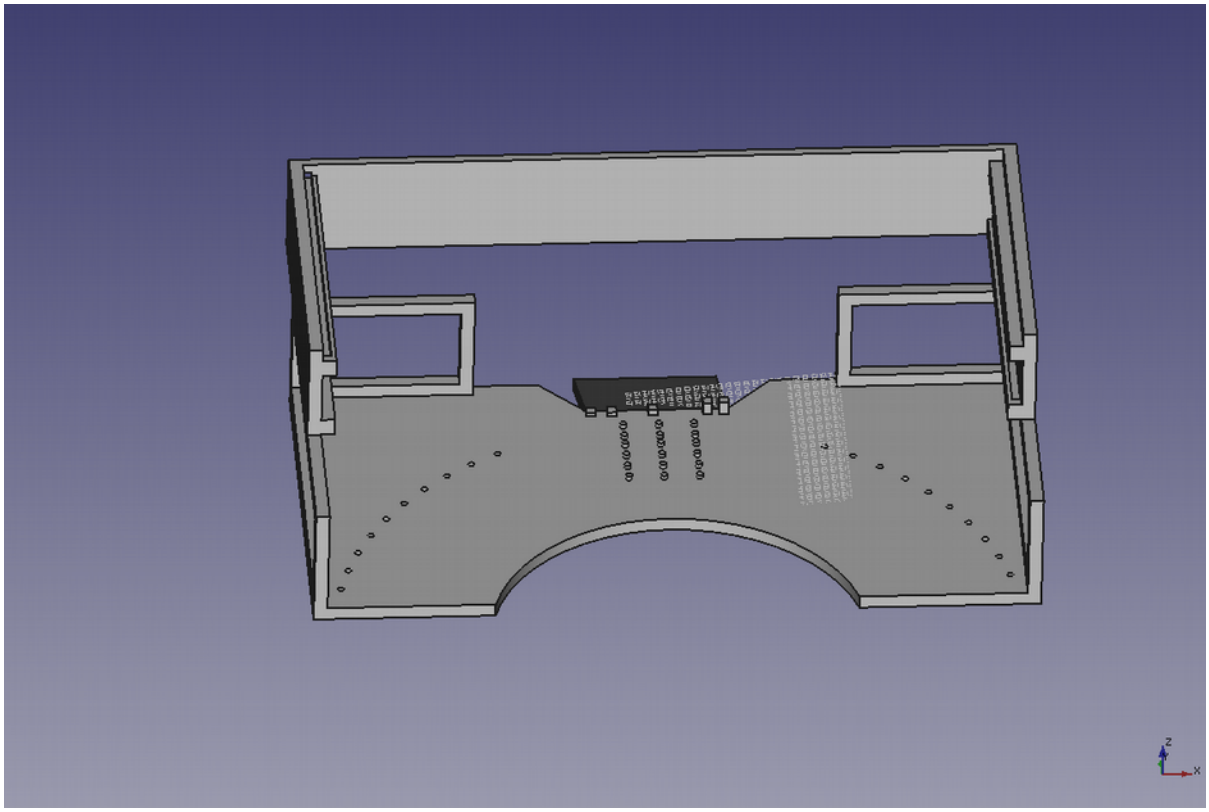
2. state of the art:

Companies have used this kind of system for a long time in order to carry heavy objects across an area and manipulate it. Which means systems which could work for this situation like:

- ELEPHANT EFAM which offers a hoist at the price of 2732.00 euros the problem here is the price is too high to buy 6 pf them.

-**AYERBE GIS:** which offers a hoist at the price of 1960.00 euros the problem here is the price is too high to buy 6 pf them.

Because of the high price and the problems of electrical energy displacement developing a solution was the only option.



3. Solution:

Of the shelf solutions wasn't economically viable and wasn't practical in that they needed the displacement of electric outlets which add costs of displacement and operating costs.

3-1Functional Analysis The system is required to respect certain functions; the following is a description of these requirements:

-Security: the system must grantee the security of the operators.

-durability: the system must be able to be operational for 24/7.

-usefulness: the system must help the operators carry the packets.

-speed: the system must be as fast as the machine's production line.

-the system must not block the operator's way and natural movement.

-no electric nor hydraulic energy is consumed.

3-2

This stage concerns decomposing higher level functions into lower level ones, Requirements presented before are deconstructed into:

-E1: carry most of the weight of the packets.

-E2: move the packets horizontally and vertically.

-E3: support the weight of the hoists and the structure itself.

The System could be represented by the following graph:

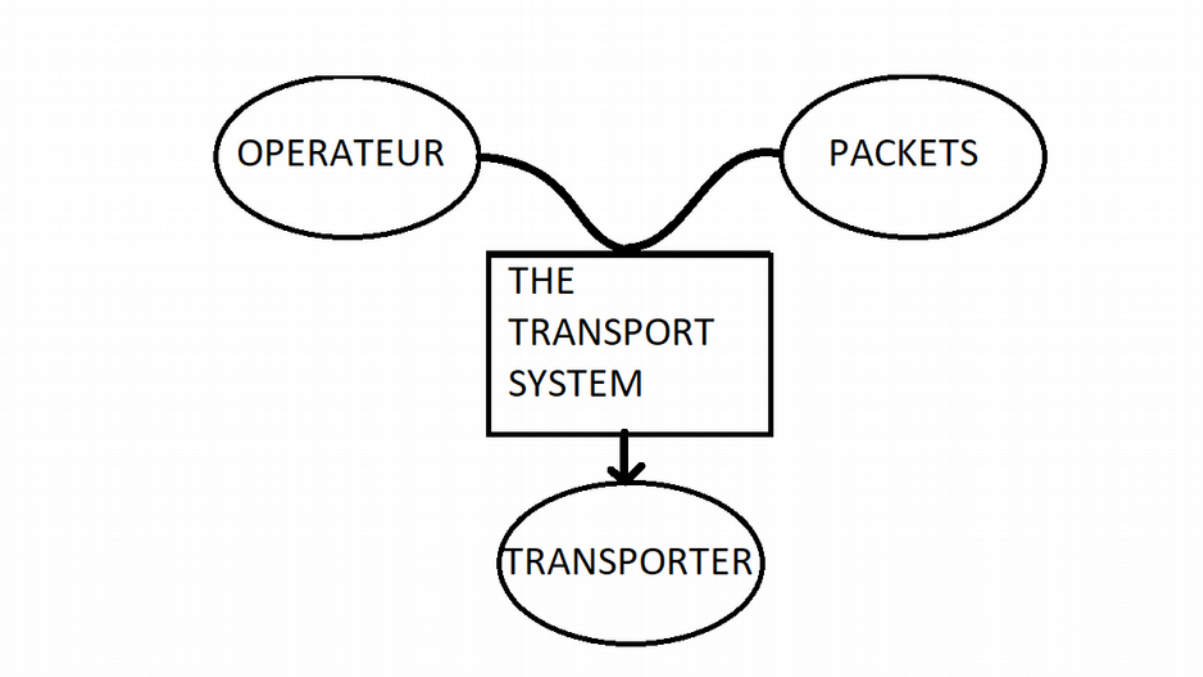


Figure 5:BETE-A-CORNE diagramme.

4-Solution Proposed:

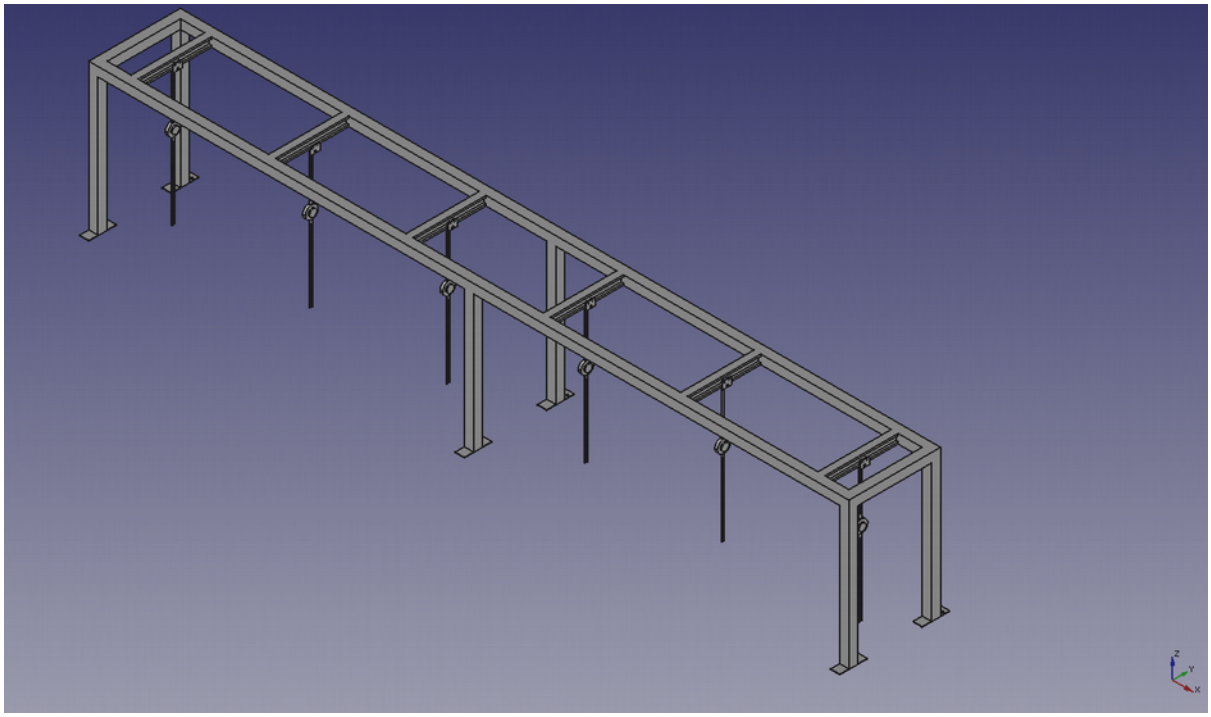


Figure 6: Structure and hoists of the proposed project.

The proposed solution is a system that uses a structure to hold hoists in the air. The hoists are held by an equipment that has wheels in order to move freely in the horizontal plane. The hoists are connected to small parts that are used to pick up the pallets. The solution is composed of several sub-systems:

The support structure to holds the system in place, it has a height of 2.5m and a width of 2 meters and length of 16.6 meter

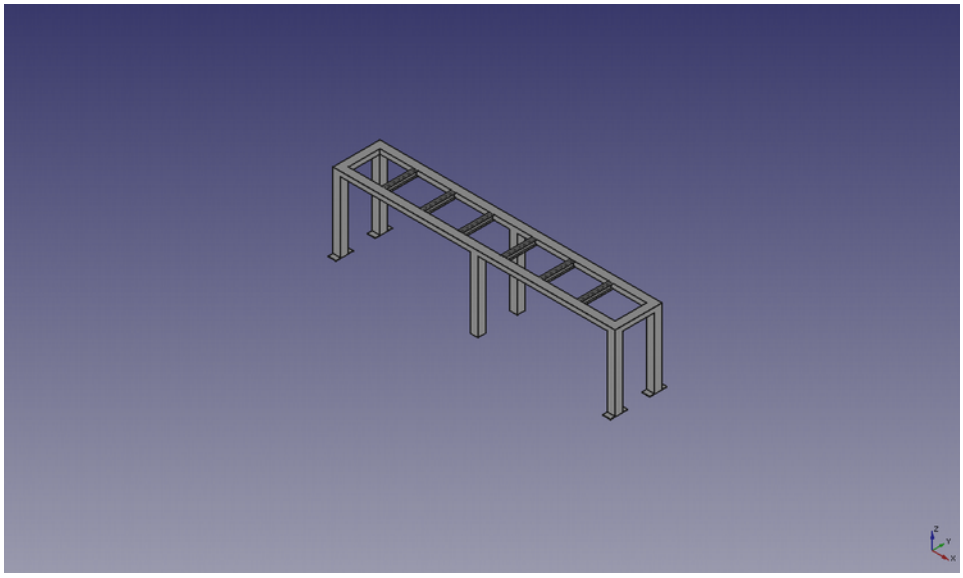


Figure 7: the proposed support structure.

The hoist and the connection to the supporting structure:

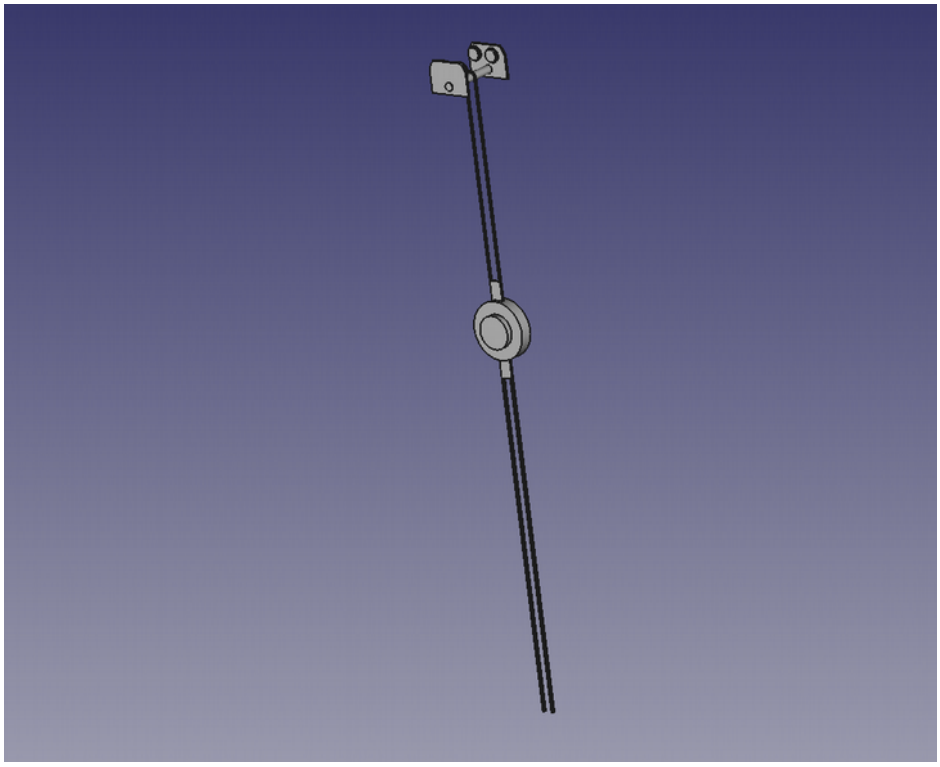


Figure 8:the hoist with its carrier with wheels.

The connection equipment is an equipment that's available with low prices, there buying it off the shelf is a better financial decision then building the equipment.

Figure 9: porter of the hoist.

The piece which is used to carry the packets from the ribbon is fabricated by a contractor of the company :

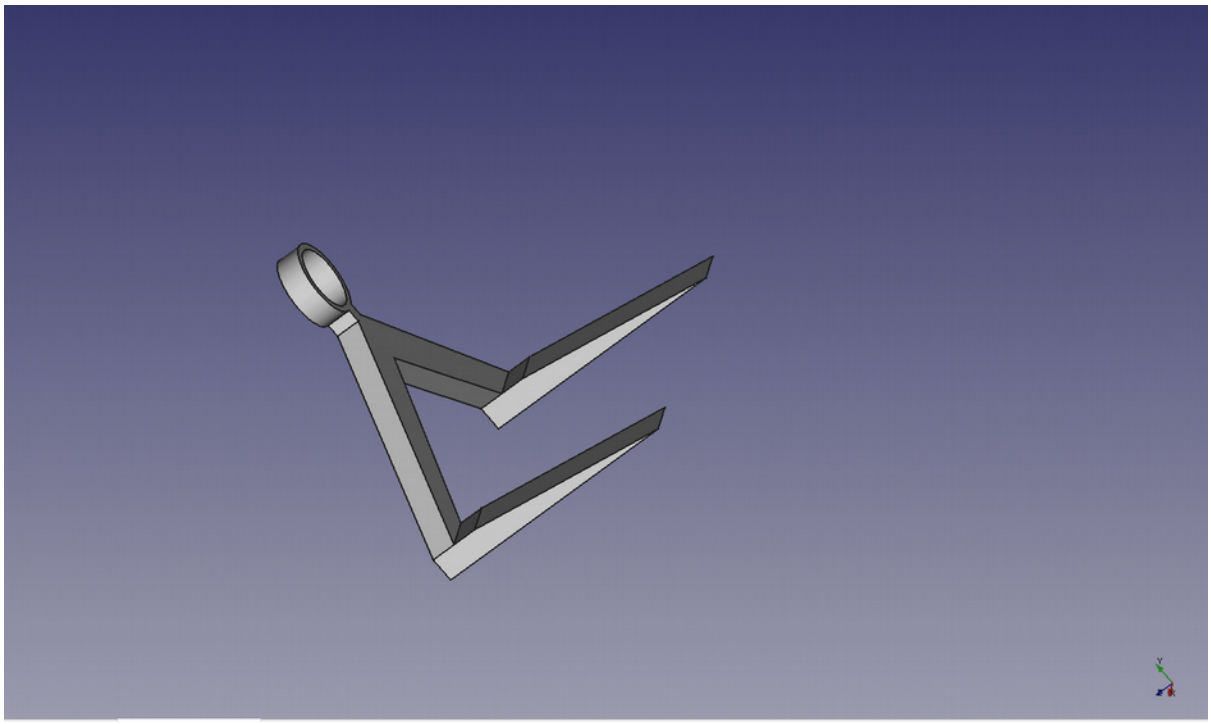


Figure 10:equipement to pick up the packets.

After a grueling search for the best weight to price ratio the best hoist was determined:

Figure 11 :hoists that were chosen for the solution proposed .

2. Table Adrexo :

1) Context:

Quality and respect for delivery dates are essential to maintain clients and a good reputation for companies. Adrexo follows the same rules. To avoid delays and inferior quality, due to machine breaking down or power outages, A system needs to be put in place to replace the automated machine in the process of making batches. This system should rely less on automation and more on operators doing Manuel work.

Operators use this system to put documents into batches inside a holder. The system needs to guarantee the same quality as the machine does. Every must be present to a certain percentage in batches. The table in hand was developed with the help of an ergonomist to facilitate the work load for the operators.

This project was divided into two parts, mechanical design part and electronics part. The next segment presents the design part of the project. The two parts are intertwined, the mechanical design needs to take into consideration the sensors or camera positioning and placement.

2) State of the art:

This system is a totally new idea, it will be patented when it's finished.

Solution :

3-1 Functional Analysis The system is required to respect certain functions; the following is a description of these requirements:

- Comfort: the operators must be comfortable.

- Speed: the design need to allow the fast movements.

-Security: the table must be safe for the operators to use.

-efficiency: the table must not force the operators to make any other gests then needed.

3-2

This stage concerns decomposing higher level functions into lower level ones, Requirements presented before are deconstructed into:

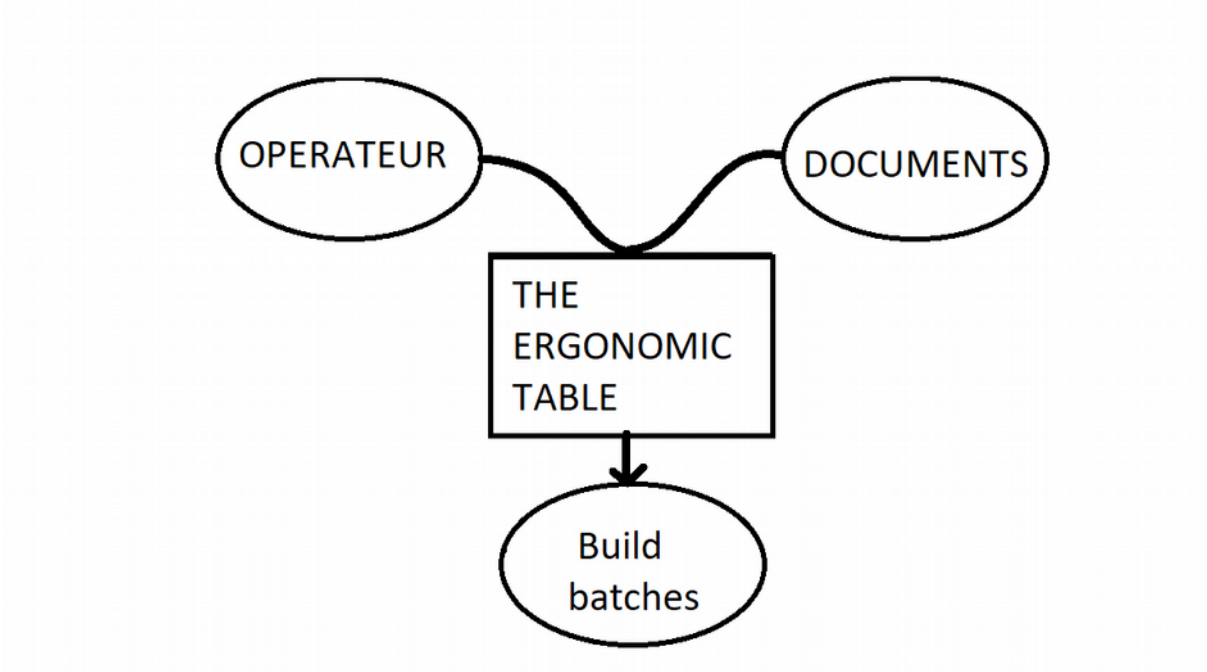
E1: the table needs to be adjustable for height and horizontally.

E2: The table evacuation system needs to be physically not demanding.

E3: easy access for sensor replacement and maintenance.

E4: Electronics must not disturb the natural flow of workers.

THIS apte diagram illustrates the system functional architecture:



3) Solution Proposed :

a)context :

The Proposed Solution is a table with adjustable legs and movable drawers. The table has three drawers, two of these drawers are movable to suite the arm length of the user. This will make the table usable by different people with different heights easily. Also, the table has holes on the back, for the cables and the electronics connected to the sensors, this installation does not disturb the operators what so ever.

For the evacuation the table has a slide to push the packets out once they are done. Then the packets will land in a conveyer belt to be further moved to their pallets and be shipped to the destination.

The material chosen is wood because of its durability and low cost of manufacturing and maintaining.

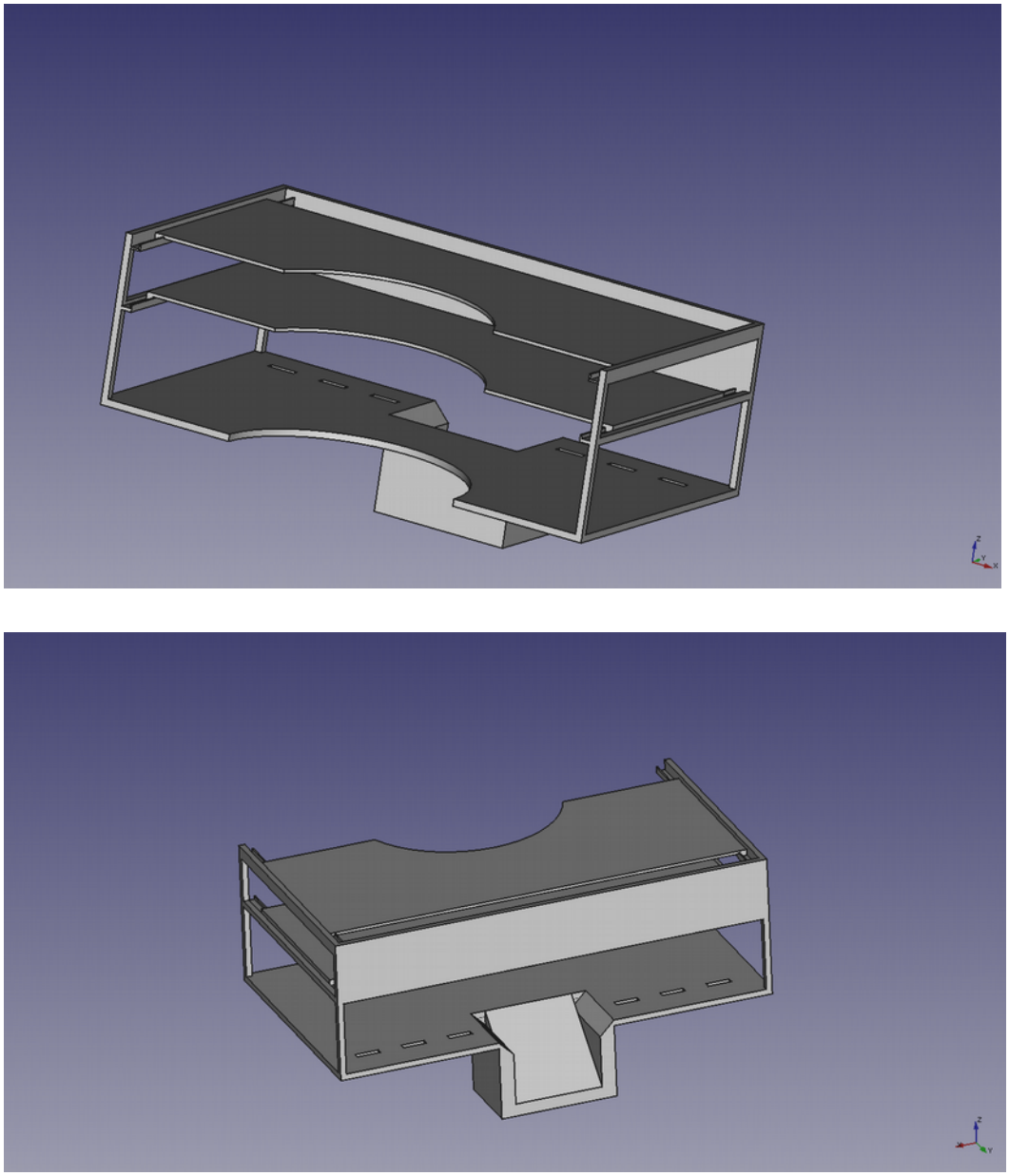


Figure 12:the proposed table.

3. net cadence and gross cadence:

a) context

Machines are complicated work of hardware and software pieces of engineering. Adrexo operates a three-million-euro machine. Some machine Features are locked by its maker. This project's goal is to get most of the information with a fraction of the cost.

The information gathered will immensely help the management and team leaders to improve the production in real time. The feedback would help identify the stations that are causing the production to slow down and correct them.

Figure 13: Machine FERAG.

b) State of the art:

The maker of the machine has offered to sell the system at a price of 53000 euros. This was economically unfeasible and more so the information provided by the system was not trustworthy, and the management wanted a more reliable and cheaper solutions.

c) Solution:

1. *Functional Analysis :*

The system is required to respect certain functions; the following is a description of these requirements:

- Security: The system must guarantee the security of operators and the machine.

- Speed: the system need to keep up with high speed of the machine.

-Cost: the system must have a financial price advantage.

-Real Time: the system must be offer the correct information at the right moment.

2. *functional architecture :*

This stage concerns decomposing higher level functions into lower level ones, Requirements presented before are deconstructed into:

-E1: the system needs to respect FERAG's security protocols.

-E2: the system needs to correctly process sensors sending data at 100 HZ.

-E3: The system needs to cost at most 35% of the offer.

3. *Solutions*:

Five solutions were proposed to the management of the compony:

Solution 1: Connecting directly to the automate BECKKHOFF.

This Solution requires the direct approval of FERAG (maker of the machine). With the approval, the programs on the API's (BECKHOFF) will be loaded to a computer and modified to send the information needed to a data base. And the information on the database will be connected to an interface for the management and another for the teams' leaders.

Materials Used:

- PC using Windows 7 or older.
- TwinCat 2 installed on the system.
- Straight through Cable ethernet RJ45.

Procedure:

- Install Twincat2 on a PC.

- connect the PC to Beckhoff CX-1030 using ethernet cables with RJ45 sockets.

- open TwinCat2.

- connect the twincat2 environment to the PLC using IP Broadcast.

- load the program from the PLC using "open from target" function.

- save the program in case of problems.

- Use the Beckhoff Twincat driver to "automatically" generate database.

- upload the new program to the machine.

- do a Test run.

Solution 2: Connecting on the I/O BECKKHOFF modules.

This solution requires the approval of the higher management. To get the information, we will use the sensors already in use by the machine maker, and read the signals using a transformer or through some electronic components to lower the voltage (form 24V for the API to 5V) for the Arduino board.

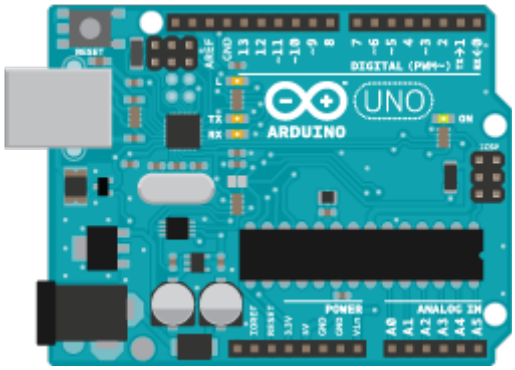


Figure 14:Arduino board.

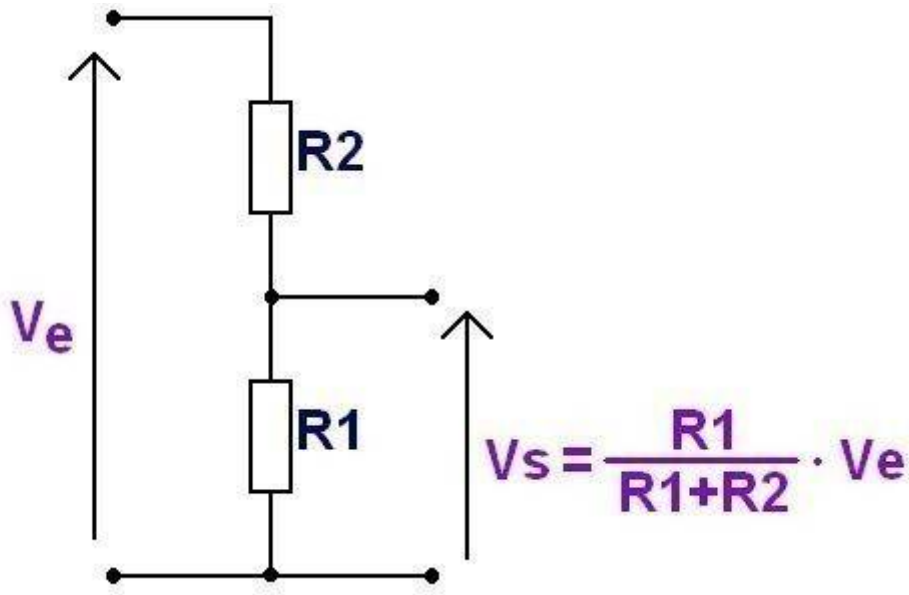


Figure 15: Voltage divisor.

Materials Used:

- PC with windows 10.
- Arduino IDE.
- Arduino Board.
- Connectors.
- Transformers 24V to 5V.
- Resistors.
- Arduino to PC cable.
- Welding station.

Procedure:

- Install Arduino IDE on the PC.
- Connect each output to a transformer then to an Arduino digital pin.
- process the data using a sketch.

- print the data on a screen.
- Centralize the data in database.

Solution 3: ADD sensors to the machine.

This Solution is the simplest, but is the most expensive because sensors and computers are needed to process the information and send them a database for further processing. The sensors needed for the job were discussed with the company's provider. Prices were around 280 euros for each one for medium precision sensor, which adds up to 7840 euros for 28 stations and around 1600 euros of

Figure 16:Keyence sensors.

Materials Used:

- PC Windows 10.
- Arduino IDE.
- Carte Arduino.
- Connecters.
- sensors (ultrasound/Barrier/laser).
- Cable Arduino to PC.

Procedure:

-
- Install Arduino IDE on the PC.
- Install physically the sensors on the machine.
- Connect the sensors to the machine.
- Centralize Data.
- Process the Data.
- Show Data in the interface.

Solution 4: Using the PLC as a Windows platform.

The PLC used on the machine can be used as a central processing unit. A screen, Keyboard and a mouse could be connected to the PLC and the information needed could be accessed directly and put to a database.

This solution requires the permission of the maker, because it is possible that the program loaded would be modified or even deleted.

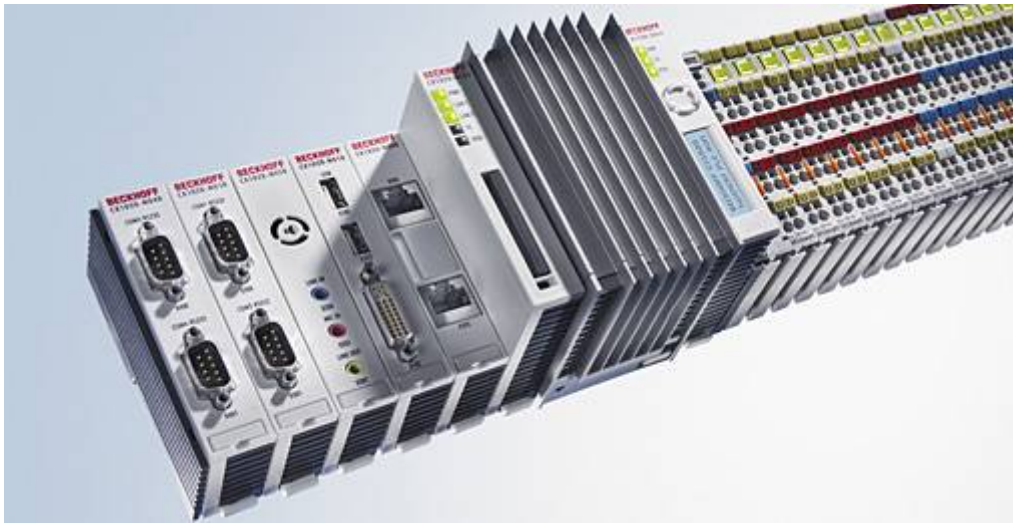


Figure 17: BECKHOFF PLC.

Materials Used:

- Screen.
- DVI-VGA male-male cable.
- Mouse.
- Keyboard.
- Internet connection (RJ45).

Procedure:

- hookup the screen to the CX-1030-N010 via the DVI input socket.
- connect the mouse and keyboard to the CX-1030-N010 module.
- Install TwinCat2 on the plc.
- Create a database using the data collected.

Solution 5: Using Cameras to monitor Inputs of the PLC.

The solution is the most optimized, it is a compromised between the others, it's costs more but it's cheaper than the most expensive, and it doesn't require permission from the maker, nor does it pose any threat to the machine.

The solution is not as expensive since instead of 280 euros for a sensor, a 1080p camera cost only 80euros. Furthermore the solution offers much more information since the camera monitors all the sensors of the stations.

Figure 18:LOGITECH Camera.

Materials Used:

- Camera.
- Spyder +python.
- PC.
-

Procedure:

- Point the camera onto the PLC Input modules.
- connect the mouse and keyboard to the CX-1030-N010 module.
- Install TwinCat2 on the plc.
- Create a database using the data collected.

THE CODE:

this code takes the video stream frame by frame and decomposes it into multiple regions and analyses the color of the regions. These regions are pre-programed to coincide with the LEDs on the input module. The states of these regions will determine the state of the inputs and will be stored in the database,

```
cap = cv2.VideoCapture(0)
cap.set(cv2.CAP_PROP_FPS, 120)
while(True):
    ret, frame = cap.read()
    if com==0 :
        com=0
        img = cv2.line(frame, (j*h+l*h,k*w), (j*h+l*h,k*w+w), (0,0,0),1)
        img = cv2.line(frame, (j*h,k*w+l*w), (j*h+h,k*w+l*w), (0,0,0),1)
        img = cv2.line(frame, (h+j*h+l*h,k*w), (h+j*h+l*h,k*w+w), (0,0,0),1)
```

Figure 20: The formula for getting OEE.

The OEE could improve the production line. The system is both built for managers and team leaders.

b) State of the art:

The OEE is a part of solution proposed by FERAG, for a cost of 53000 euros.

c) Solution :

1. Functional Analysis:

The system is required to respect certain functions; the following is a description of these requirements:

- Security: the system guarantees the security of the operators and the machine.

-Speed: the system needs to keep up with the speed of the machine.

-efficiency: the system must give as much information as possible.

2. Fonctionnel architecture :

This stage concerns decomposing higher level functions into lower level ones, Requirements presented before are deconstructed into:

-E1: the system needs to respect FERAG's security protocols.

-E2: the system needs to correctly process sensors sending data at 100 HZ.

-E3: The system needs to be cheaper than 500 euros.

3. Solution :

The solution was to use low cost IR sensor for their high frequency and their precision. These sensors will be connected to an Arduino board because of its low cost and modulable. The Arduino is equipped with an ethernet shield. The ethernet shield permits the board to transfer data over a network. The sensor will count the number of documents that are classified as good, and the ones that are rejected. Also, using the same technology the stop time will be counted. The faulty documents that go around in the machine is counted also in order to build OEE.

There are multiple phases in the construction of the project:

```
<?php
$mysqli = new mysqli("192.168.18.216", "simo", "simo", "arret_ferag");
$temp="SELECT id,valeur FROM farr ORDER BY id DESC LIMIT 1";
$result=mysqli_query($mysqli,$temp);
$row = mysqli_fetch_array($result);
if($row[1]==0){
$up="update farr SET fin=now(),valeur=1 WHERE farr.id=$row[0]";
mysqli_query($mysqli,$up);
}else {
$sql = "INSERT INTO arret_ferag.farr (valeur) VALUES ('".$_GET["value"]."')";
mysqli_query($mysqli,$sql);}

echo'dd';
echo 'Connected successfully';
```

-First: the IR sensor detects the presence of a part of the machine that moves, if there is no change in under 350ms it means the machine has stopped. If the machine detects a stop it and writes the start time of that stop, after the machine ha restarted the board sends the finish time of the stop along with an integer for the state of the operation. the database writes the time of stop and passes to a new row.

-Second: The IR sensor detects the presences of documents, and transmits this information to the Arduino board which counts the number of documents and at every stop sends the information the

database. The board sends this information in two phases, when the presence is detected, a first information is written about the start time, the second phase is when there are no more documents or there is a stop in the machine, at this point the number of documents that passed is counted and written to the database with a state binary.

Figure 21:the sensor and Arduino board.

Third: This phase is the cleaning phase, where the data is cleansed from the bad products. The products are separated into 3 categories, good, rejected and reused. Four sensors were installed to count all of these, one for the total, one of the rejected and tow for the reused.

```
<?php
$mysqli1 = new mysqli("192.168.18.216", "simo", "simo", "capteurs_ferag");
    $temp="SELECT id,fin,valeur FROM poi ORDER BY id DESC LIMIT 1";
    $result=mysqli_query($mysqli1,$temp);
    $row = mysqli_fetch_array($result);
    if($row[1]=="" or is_null($row[1]) or empty($row[1]))
    {
            $up="update poi SET fin=now(),valeur=1,nbr=('".$_GET["value"]."') WHERE
            poi.id=$row[0]";
            mysqli_query($mysqli1,$up);
    }else {
    $sql = "INSERT INTO poi (valeur) VALUES ('".$_GET["value"]."')";
    mysqli_query($mysqli1,$sql);
    }
mysqli_close($mysqli1);
?>
```

Fourth: the processed data is taken and put into a separate database and this database is used to project the information to the graphic.

```
$mysqli = new mysqli(DB_HOST, DB_USERNAME, DB_PASSWORD, DB_NAME);
$query = sprintf("SELECT t1.Graph_Sem, t1.Graph_Start, t1.Graph_PrevCad, t1.Graph_ProdPg,
t1.Graph_Jour, t2.Pg, t2.HeureRequete, t2.NbInt,
                        t3.trs_id,t3.trs_Sem, t3.trs_Heure, t3.trs_Qte FROM
                        (SELECT Graph_Sem, Graph_Start, Graph_PrevCad, Graph_ProdPg, Graph_Jour
FROM graphsetting WHERE Graph_Sem = (SELECT MAX(Graph_Sem) FROM graphsetting) ) AS t1,
                        (SELECT COUNT(nbr) As NbInt, SUM(nbr) AS Pg, now() AS HeureRequete FROM
poi WHERE debut BETWEEN NOW() - INTERVAL 10 MINUTE AND NOW()) AS t2,
                        (SELECT * FROM trs WHERE trs_id = (SELECT MAX(trs_id) FROM trs)) AS t3");
$result = $mysqli->query($query);
while ($row = $result->fetch_assoc()) {
    // calcul l'interval entre la table TRS et POI
    $datetime1 = new DateTimeFrench($row['HeureRequete']);
    $time1 = date("Y-m-d H:i:s");
    $datetime2 = new DateTimeFrench($row['trs_Heure']);
    $time2 = date("Y-m-d H:i:s");
    $interval = date_diff($datetime1, $datetime2);
    //echo $interval->format('%i minutes'). "\n";
    //echo "toto " .date('w', strtotime($row['HeureRequete'])) . "\n" ;
    if ( empty($row['Pg'])){
            $row['Pg'] = "0";
    }
    // Si l'interval est supérieur à 10 minutes, insertion en BDD
    if ($interval->format('%i') >= 10){
            $query = sprintf("INSERT INTO trs (trs_Sem, trs_Heure, trs_Jour, trs_Qte) VALUES (".
$row['Graph_Sem'] .", '" . $time1 . "',
                    \"".$datetime1->format('l') ."\" , " . $row['Pg'] . ")");
            $mysqli->query($query);
    //      echo " INSERT INTO trs (trs_Sem, trs_Heure, trs_Qte) VALUES (". $row['Graph_Sem'] .", \"" .
$time1 . "\",
    //      \"".$datetime1->format('l') ."\" , " . $row['Pg'] . ");";
    }
    // creation tableau POST Prod
    $dataProd = array('Graph_Sem' => $row["Graph_Sem"], 'Graph_Jour' => $row["Graph_Jour"],
'Graph_Start' => $row["Graph_Start"],
            'Graph_ProdPg' => $row["Graph_ProdPg"], 'Graph_PrevCad' => $row["Graph_PrevCad"],
'Graph_NbSplot' => (ceil($row["Graph_ProdPg"]/$row["Graph_PrevCad"])*6) );
}
```

Figure 22:Graphic of the solution.

The sensors used in this solution are all placed in this part of the machine.

Figure 23:the machine Ferag and the position of the sensors.

Conclusion :

This Internship Has allowed me to acquire more theoretical knowledge but more importantly more practical knowledge and the hands-on experience of the field. As the weeks went on I discovered the dynamic of the company more and more. Decision needed to be taken by the management, Ideas should be formulated and presented the immediate superior for validation, and budgets needed to be approved. This dynamic was hard to get used to at first but with time I started to realize that it is be well thought out and very efficient way to assign responsibility and to manage risk. Some aspects of the technical part was quit hard to figure out especially when cost was always a factor.

Annex:

Risque management:

Option :	Connexion à l'automate Beckoff
Identifiant :	OP1_R1.
Auteur de risque :	Elève Ingénieur.
Date d'enregistrement :	22/06/2017.
Catégorie de risque	Technologique.
Description de risque :	Ecraser ou modifié le programme enregistré sur l'automate.
Probabilité :	60%.
Impact :	Arrêt de la production.
Valeur attendue	Accès à toutes les informations de la machine.
Proximité :	Durant la manipulation.
Catégories des réponses au risque :	Opportunité.
Réponse au risque :	Utiliser la documentation et les informations fournit par Beckhoff.

Etat de risque :	Clos.
Surveillant de risque :	Jean-Christophe MERCIER, FERAG.
Exécuteur de risque :	Elève Ingénieur, Eric Roux.
Finalité	Permettre l'affichage de la cadence Nette et Brute de la machine.
Composition	- Matériel existant (Beckoff EK1100) - Alimentation électrique de la machine - Carte Arduino
Origine	Equipement Beckhoff EK110 se trouvant dans l'armoire ESR
Compétences requises	Domoticien / Automaticien Electromécanicien
Responsabilité Qualité	Producteur : Stagiaire Elève Ingénieur Vérificateur : Responsable maintenance Approbateur : FERAG
Méthode Qualité	Définir un protocole détaillé des tests à effectuer pour valider le fonctionnement normal de la ligne FERAG.
Compétences requises en matière qualité	Producteur : Elève Ingénieur Vérificateur : FERAG Approbateur : S. MARCHAND

Risk op2

ID:	OP2_R1.
Risk writer:	Student engineer.
Date:	22/06/2017.
Type of risk:	Technological.

Description of the risk:	Risk of a wrong contact or creating a short circuit on the module.
chance:	20%.
Impact:	Ruin a part of the modules I/O.
Valeur attendue	Accès à toutes les informations de la machine.
Proximité :	Durant la manipulation.
Type of response:	Opportunity.
Response to risk:	Utiliser la documentation du Beckhoff et de la carte Arduino.
State of risk:	Clos.
Supervisor of the risk:	Jean-Christophe MERCIER, FERAG.
Executer of the risk:	Student Engineer, Eric Roux.
goal	Obtain the true production cadence and Statistics.
Required skills	Automatic Electro mechanic
Quality Responsibility	Producer: Student Engineer Verification: advisors Approval: FERAG
Quality Method	Define a detailed plan of actions to guarantee the nominal function of the FERAG line.
Skills needed in Quality Method.	Producer: Student Engineer Verification: FERAG Approval: S. MARCHAND

Sol

Option :	Installation des capteurs additionnel.
Identifiant :	OP2_R1.
Auteur de risque :	Elève Ingénieur.
Date d'enregistrement :	22/06/2017.
Catégorie de risque	Technologique.
Description de risque :	Risque de l'emplacement des capteurs.
Probabilité :	5%.
Impact :	Les informations capter ne sont pas exacte.
Valeur attendue	Accès à quelques informations de la machine.
Proximité :	Durant la manipulation.
Catégories des réponses au risque :	Opportunité.
Réponse au risque :	Utiliser la documentation du Beckhoff et de la carte Arduino.
Etat de risque :	Clos.
Surveillant de risque :	Jean-Christophe MERCIER.
Exécuteur de risque :	Elève Ingénieur, Eric Roux.
Finalité	Permettre l'affichage de la cadence Nette et Brute de la machine.

Composition	- Alimentation électrique de la machine - Carte Arduino
Origine	- Chaque poste d'alimentation.
Compétences requises	Domoticien / Automaticien Electromécanicien
Responsabilité Qualité	Producteur : Stagiaire Elève Ingénieur Vérificateur : Responsable maintenance Approbateur : Jean-Christophe MERCIER.
Méthode Qualité	Définir un protocole détaillé des tests à effectuer pour valider le fonctionnement normal de la ligne FERAG.
Compétences requises en matière qualité	Producteur : Elève Ingénieur Vérificateur : Jean-Christophe MERCIER. Approbateur : S. MARCHAND

Project Hoist.

Proposition d'un Balanceur

Réalisé par : Encadré par :

-Mohamed OUTAHAR

-Simohamed NASER

-Sébastien MARCHAND

Introduction :

ADPROD, société spécialisée dans la composition de poignets des documents pour les distribuer dans des boites aux lettres dans des secteurs précis, utilise une machine de type FERAG. A la sortie de cette dernière, les opérateurs portent manuellement les paquets lourds à partir du convoyeur pour les stocker dans des palettes. Cela à pousser la direction à chercher une solution pour ce problème.

Problématique :

A la sortie de la machine FERAG, les opérateurs stockent manuellement les paquets dans des palettes. Un paquet pèse entre 5 et 7 kg, ainsi pour XX paquets par jour, un operateur est amené à soulever XX kg chaque jour. Plusieurs problèmes se posent :

- mauvaise condition de travaille.

- la fatigue (diminution de la productivité).

- les femmes ne peuvent pas travailler dans ces postes.

-les operateurs ne changent pas leurs postes chaque 2 heures.

-augmentation des chances des accidents de travail.

Solution :

La solution proposée est l'installation à la sortie de la FERAG d'une machine qui va soulever la plus grande partie du poids à la place des opérateurs. La machine est composée de trois parties : un frame, un balanceur et une main :

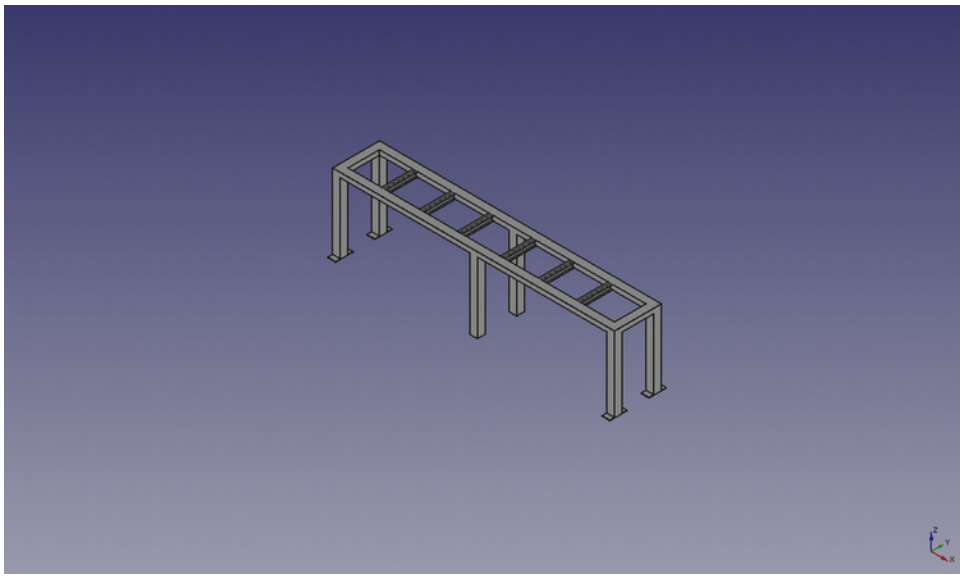


Figure 24 : frame de la machine.

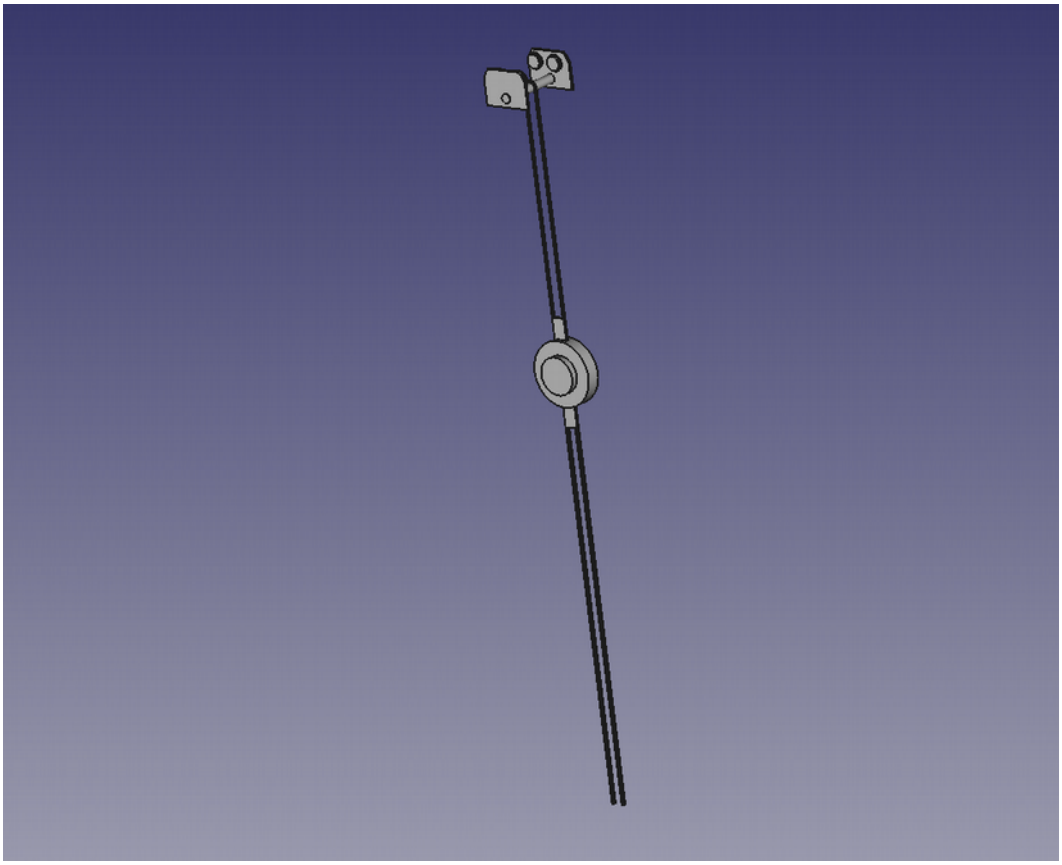


Figure 25 : balanceur avec enrôleur chariot.

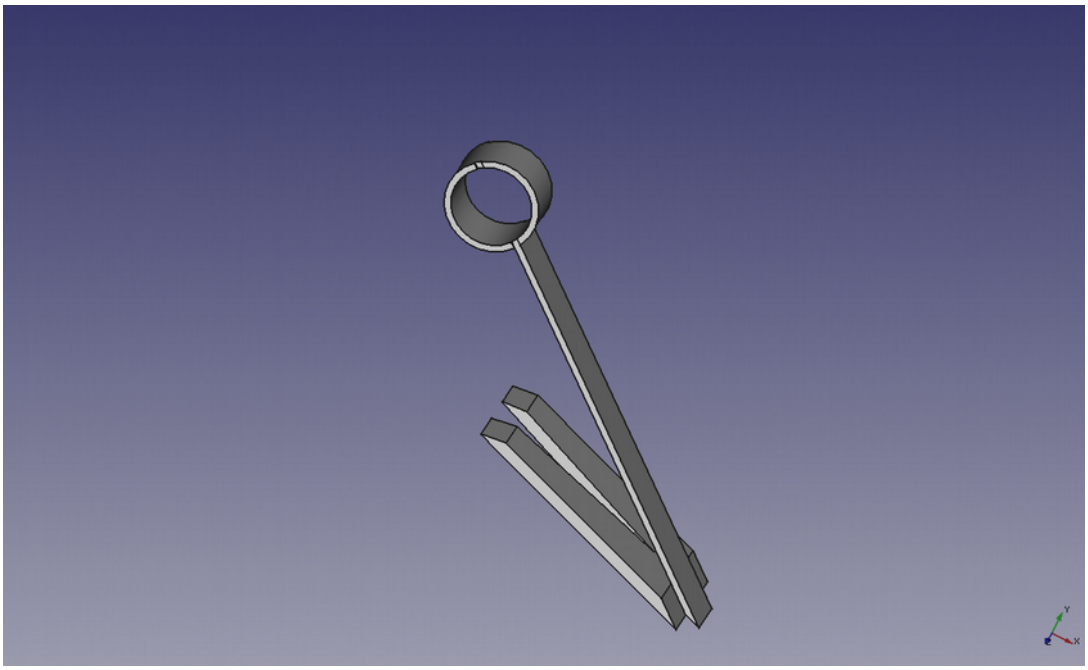


Figure 26 : main pour prendre les paquets.

Etat de l'art :

Pour des questions de complexité, de temps et de coût de développement, on a choisi d'acheter des composants et de ne construire que le frame et la main.

- Enrouleur chariot porte palan : plusieurs modèles existent. Pour valider notre choix nous nous sommes basés sur les critères du prix et de la robustesse. L'enrôleur choisit, de la marque Mitrai, arrive à porter un poids de 1000 kg et coûte 98,90 euros.

Figure 27 : Enrôleur chariot MITARI.

- Le choix de l'équilibreur a été fait pour à sa robustesse. L'équilibreur retenu est celui de la marque ALTLAS COPCO

Figure 28 : Equilibreurs d'ATLAS COPCO.

-la frame à construire :

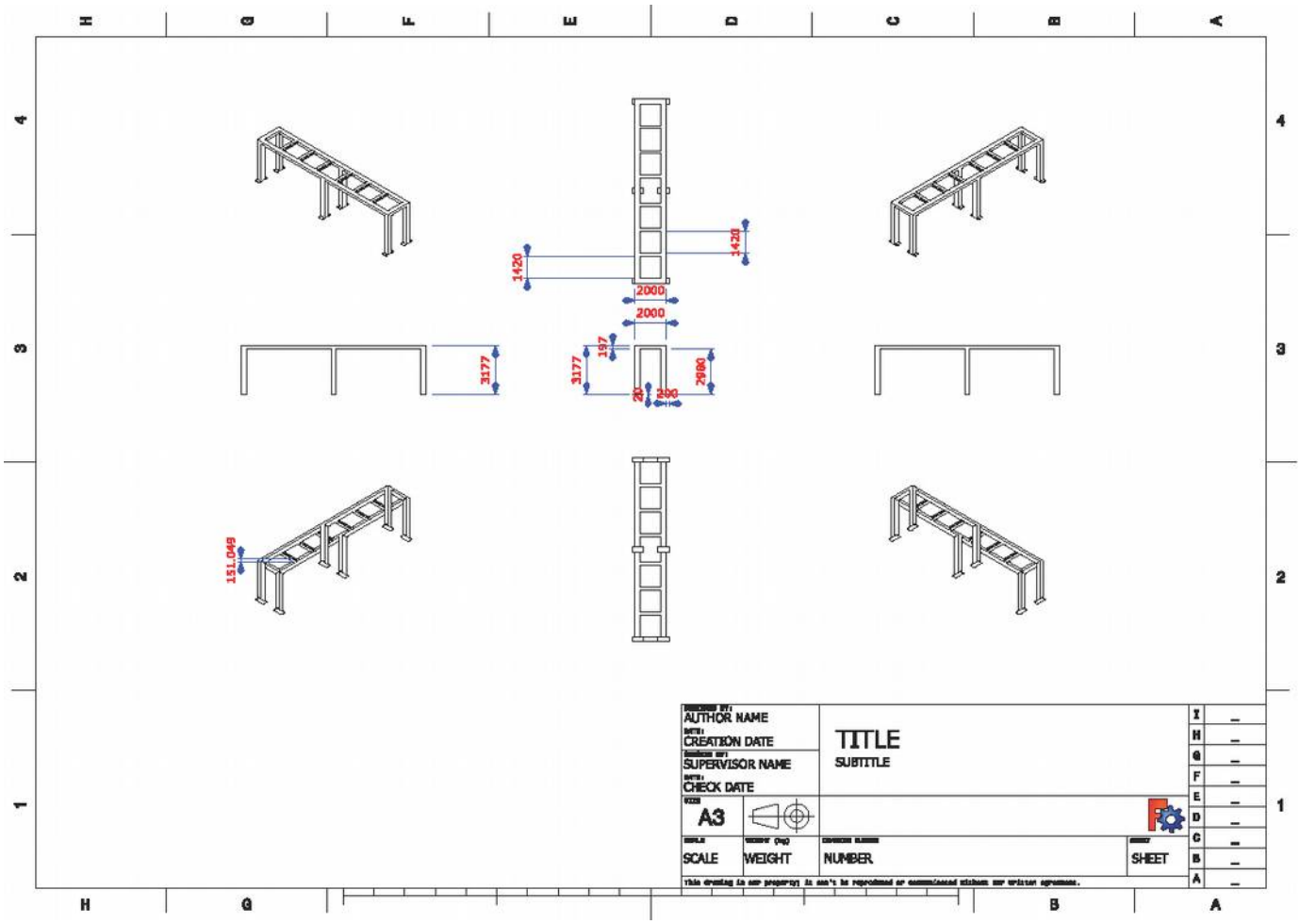
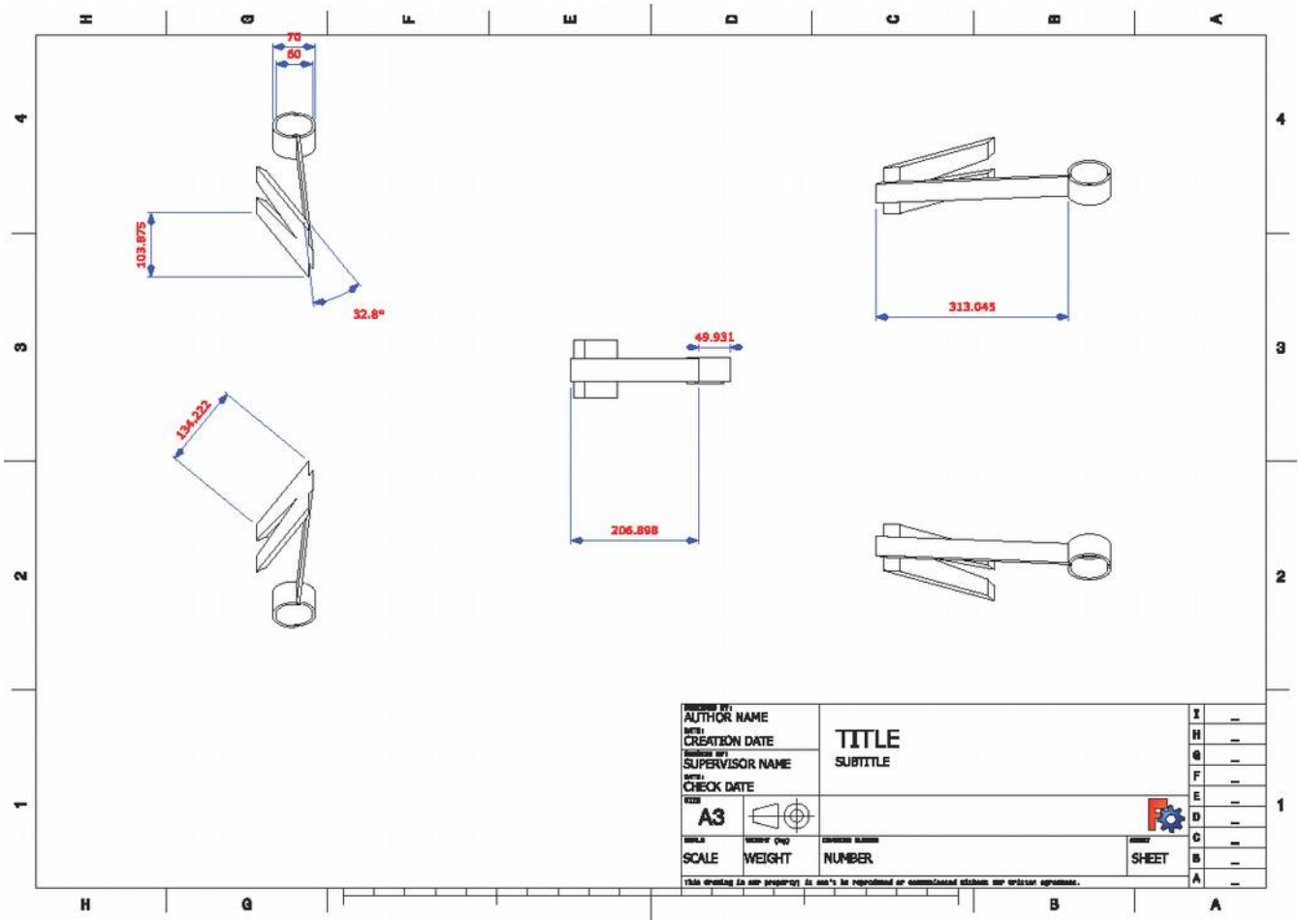


Figure 29 :design du frame.

-la main à construire :

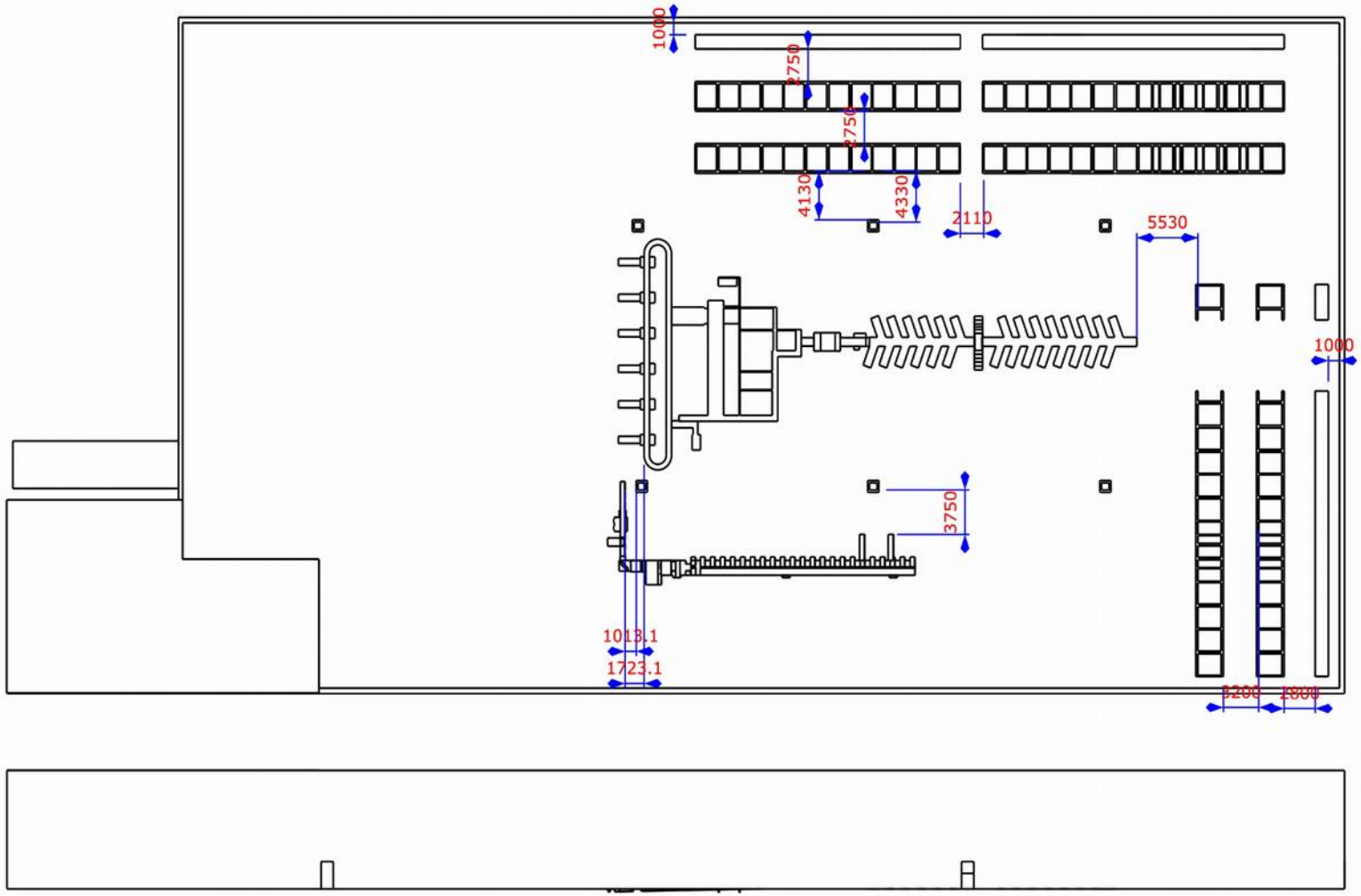


Estimation :

- L'équilibreur coûte 138 euros.
- L'enrôleur coûte 98.32.
- Le frame coûtera 1000 euros.
- Une main coûtera 15 euros.

Pour une estimation totale du prix de :

-2512 euros.



DESIGNED BY: AUTHOR NAME DATE: CREATION DATE		TITLE SUBTITLE	
CHECKED BY: SUPERVISOR NAME DATE: CHECK DATE			
SIZE A3			
SCALE SCALE	WEIGHT (kg) WEIGHT	DRAWING NUMBER NUMBER	SHEET SHEET

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