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Training Environment and Material for New Commissioning Engineers

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Purpose of this thesis work was to create and study a way to improve Rocla Oy training program and same time start creating new training assignments for all the new commissioning engineers that would join up with Rocla's commissioning team.

Right now, Rocla does use any training program for new commissioning engineers and it has caused problem. This study gives a suggestion to fix this situation. Suggestion is to take all the training material inside of an LMS based learning platform and from there every new commissioning engineer could find all the necessary information and assignments to improve their learning process. Because some the assignments have physical training assignments there was need to find place to do this one to.

This project it was identified problem points and offer a solution for the problem. Solution would ease the training of future commissioning engineers. That included the material and means to do so and the physical place.

Keywords	Rocla, Rocla Oy commissioning engineer, engineer, training

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Tässä työssä tarkastellaan Rocla Oy:n käyttöönottoinsinöörien koulutusjärjestelmää. Tarkoitus on myös luoda koulutusympäristö ja -materiaali tuleville käyttöönottoinsinööreille. Lisäksi on tarkoitus tarkastella tapaa, jolla koulutusmateriaali voitaisiin jakaa.

Tällä hetkellä Roclalla ei ole käytössä mitään tiettyä koulutusjärjestelmää. Työssä esitetään yksi mahdollisuus tilanteen korjaamiseksi. Ehdotuksena on siirtää kaikki koulutusmateriaali LMS-pohjaiseen oppimisalustaan, mistä jokainen uusi käyttöönottoinsinööri voisi löytää tarvittavan materiaalin. Työssä on myös esitelty suunniteltu fyysinen paikka oppimisharjoitusten tekemiseen.

Tässä työssä pystyttiin tunnistamaan ongelmakohdat nykyisessä tavassa perehdyttää uudet käyttöönottoinsinöörit. Työssä tarjotaan ratkaisu ongelmiin ja esitetään ehdotus koulutusjärjestelmäksi. Uusi koulutusjärjestelmä tulisi huomattavasti helpottamaan tulevien käyttöönottoinsinöörien koulutusta.

Avainsanat	Rocla, Rocla Oy, commissioning engineer, engineer, training

Contents

List of Abbreviations

1   Abbreviations

AGV   Automated Guided Vehicle, overall term when talking about automatic ve-
           hicles.

Vihi   AGV, first vehicles in Rocla's production they called by this name.

LMS   Learning management system, describes a system that is used to teach
           various things.

ATX   Automatic truck X, Rocla's first generation AGV vehicle.

ART   Automatic Reach Truck, third generations vehicle main purpose to be used
           in tighter corridors.

AWT   Automatic warehouse truck, second generation vehicle.

LHU   Load Handling Unit, description the whole mechanical and electrical parts
           that have reasonability of lifting, lowering of load.

PPA   Physical Parameter Adjustment, Navigation scanners X, Y and angle tun-
           ing in purpose of having better working navigation.

GDPR   General Data Protection Regulation, is the set of regulation and rules that
           EU has set for the EU countries and countries that are inside of European
           economic area.

MCFE   Mitsubishi Catepillar Forklift Europe, branch of Mitsubishi and owns Cat
           and Rocla Oy.

SOC   System and Operation Controls, Audit system for information systems that
           is built by AICPA.

AICPA   American institute of certified public accounts, company that main purpose
           is to create rules for company for fair play.

SSAE16   Older audit system it was replaced by SOC.

EU   European Union, collection of countries inside of Europe continent.

I/O   Input/output, the communication ports between information processing system and outside sensory information.

EEA   European economic area, is extension of EU trade area.

WMS   Warehouse management system, software or application that betters the warehouses functionality and distribution of goods.

CPU   Central processing unit, Central processing unit of most the information from PC.

PLC   Programmable logic controller, is programmable controlling unit that is used in industry.

Wlan   Wireless local area network, is system that is used to communicate between various machines that don't have hard line connection.

IP   Internet protocol, set of rules that are used to communication through internet or other networks.

CDS   SICK Software, made for programming sick instruments.

Flex   SICK Software, made for programming sick systems that has flex safety logic.

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2   Introduction

The purpose of this thesis work was to create a new learning environment and exercises for new commissioning engineers and this way to speed up the learning process of new commissioning engineers.

To this day Rocla Oy has not had or has not used any kind of training program for new commissioning engineers. Now that there are new guidelines given by upper managers of Rocla's AGV department on how fast every engineer needs to be trained so that they can independently work in field situations. There needs to be some improvements in the learning process and not just have new engineer come to Rocla and teach them self all the tools and skill they need. The purpose of this documentation is to start program that in future engineers could use to improve them self

This documentation alone does not fix all the needs, but it is a start in looking into the training process to fix it the if not total the fix to at least the process where Rocla could build it. In this documentation, the first step was to look at Rocla Oy old training program/materials. The first point is to look at what Rocla Oy need out of this training program and identify problem points. The second is to go through old material and upgrade this if there is need for it. The third is to create new exercises. Fourth is to think of place where training could be done/organized. Fifth Would be to look into different teaching methods and pick something that could work. After every following point is done there should be good starting position for speeding up the new commissioning engineers learning process.

3   Rocla

Rocla is a Finnish company first started in 1942 and founded by Evert Stigzalius. This time Rocla made stoves and beds. Around 1950 the company changed its production into Lifting tools for warehouse use. [13]

At this time Rocla still carried the name Rautatyö Oy. In 1979 name of the company was changed from Rautatyö Oy to Rocla Oy, the first electric powered forklifts came into production in roughly 1967. [13]

the first vihi systems came into use about 1983. These early automated warehouse trucks turned into the current AGV forklifts that Rocla is selling worldwide and already has more than 7000 AGVs sold. [2]

Rocla began to collaborate more closely with MCF (Mitsubishi Caterpillar Forklift). [4] and six years later joined the MCFE family but managed to maintain the ODM which means that Rocla still continues to manufacture its own design even though owned by MCFE. and is part of the larger Mitsubishi logisnext Co, Ltd. [1]

Rocla has offices in Järvenpää and in Vantaa. The Järvenpää office operates is the main location for the production of electric forklifts, assembly of AGV vehicles and location for the main office and R&D. Vantaa office is intended as a maintenance area for manual trucks and as an exercise area for customers. Rocla has two subsidiaries in Denmark Rocla Denmark A / S and in Russia Rocla RUS OOO. [3.

Rocla supplies a wide range of various transfer and lifting tools to warehouses, including pallet trucks, scissor trucks, forklift truck, stacker, reach truck, narrow aisle truck, automated guided vehicles. [14] Rocla's market area covers the whole planet, but Europe is a main market area where Rocla is at its strongest. Company has its own maintenance and spare part for servicing Rocla's vehicles worldwide. Rocla employs some 500 people and has a turnover of approximately 124 million EUR during the 2018.

4   Rocla Training Program at Present

Rocla does not have any current training program in place for teaching new commissioning engineers. All the learning is done as in work learning. Often time this leads to every engineer learn different things at different times and there can be lot of bad practices and shortcomings in knowledge that this can cause. There are a lot of practices that are not as effective or good as they could be. This type of work can lead into mistakes and slowdowns in whole project, which can cause monetary loss for company and pointless stress for engineers doing commissioning work. Streamlining this process into more intense and effective program could lead in much better results for every part of the project that is under work.

Company new guidelines are to train every new engineer in four months of coming to Rocla and this time period will be split in three different phases. First one is for new engineers to go work under assemblers and get to know how the vehicles are built and how they work mechanically and electricity wise. this would happen at the Järvenpää location it will take about three. In the phase, every new commissioning engineer will take Kollmorgen training program that include more of the software side of all the tools that new commissioning engineer would need. Main focus on the Kollmorgen training will be study software that is directly made and designed by Kollmorgen (vehicle application designer, system manager, cway, System application designer, Reflector and vehicle diagnostic tool). This incursion lasts two weeks outside office in Kollmorgen site in Sweden, plus two weeks office hours doing internet assignments that are given by Kollmorgen web portal learning portal. After this new engineer will take Rocla's own training program that covers maters that haven't come up in previous two parts. Rocla's own program would take rest of the 4-month planned duration and this would leave about 2 months for every new commissioning engineers to learn basics of commissioning system and how Rocla works. After this the engineer should be able to work in customer's site and mostly do things independently.

5 What Rocla Needs?

Project started as discussion inside Rocla, especially in the AGV department: what are the problem points and where Rocla needs to improve. Here are some of the points that make the new engineer experience learn hard. There is lot of old and new manuals mixed up in multiple different locations. There is no proper place where training could be arranged so far. No one really has time to do hands on teaching, so lot of times training is done as onsite self-learning witch already is not seen the best way to learn things.

Following point are what are taking in count when design in the system.

1. Organize and update all of the old manuals and guides

2. Create new manuals

3. Create assignments that new engineers can do on they own.

4. Have dedicated place and platform that student can use.

5. Have necessary hardware, tools and software so new engineer could use them anytime.

6. Who are the future students? Or what type learners they could be?

6 Who are the Students

All the future trainees are going to be Engineers from mechanical, electrical and automations field. They all will have engineering degree or close to graduating from school. will have the basic understand of mechanics, electrical system and coding languages.

7   Teaching Method

Now that there is an idea what are the problem point and what should be points to work on. Next step would be to start wonder what type teaching method would be best suited for the situation that Rocla has. Some of the possible Methods have been gone through in next part. They are separated into three ways to store learning material. They would be Guided teaching, Companywide network/intranet and LMS based system.

7.1   Guided Teaching and Dedicated Area

Something of this type of learning could be arranged with test department that is situated right next to assembly lines. It could be possible for anew commissioning engineer to go to testing for certain time period to learn how to test and tune all the parts of the AGV. This would be really good learning by doing and this is how I started my work in Rocla. From my personal experience it helped me to understand much better about whole picture. But the problems here are that testing doesn't have time to teach every new commissioning engineer because they have lot of work there and very limited manpower. Big minus in this type of learning is that are major problems when it comes to learning about the system, layout, reflectors etc. which are necessary to know when you are commissioning vehicles in client's site. On this method all the information and material would be shared by dedicated teacher.
Other option would be if Rocla signs a person to be teacher to new commissioning engineer, but this would be too hard. There is no one who could do this and do other duties they have at the same time.

7.2   Self-Learning

This option has already been tried multiple times but has not been able to produce results that are necessary and that's way Rocla is moving away from it and finding better solution that could bring improvements.

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7.3   Company wide network drive and Dedicated area

This one could be good option when Rocla has dedicated a place to do physical assignments and have already prepared all the necessary material so that new commissioning engineer could move him or herself easily to training area and use guides that have already been made to work on the assignments. This type of training would not need to have teacher. It would only need place where new commissioning engineer would do all the assignments. Pre-made documents would be easy to modify so that if there are any chances to any of the assignments, it would be really fast to modify by anyone, and you would not need to have signed teacher for this modification. Similar environment place could be created inside Rocla's shared folder under system engineers and this could basically work same way, but it would give it so that not everyone could get access to this information and it would add extra security for all information.

7.4   LMS based system and Dedicated area

This type system could give same benefits that company network drive or shared place inside Rocla`s network. But it could have a couple big bonuses one is the ability to hold test and quizzes to test new commissioning engineers are learning and at the same time having better ability to follow how far has the commissioning engineer got with his/hers training program. It could be something that Rocla could sell for partners that Rocla has and who are doing their own commissioning's but do not have any way to train things that they need to know. This type system would need to have a person that has known how to keep systems in working condition and when there is need for can do modifications to systems that needs to be done in any of the assignments or material that needs to be modified or chanced. One negative aspect would be that is needed internet to have access to this type of system.

8 Learning Platform

LMS type platform combined with dedicated area is the best method for Rocla. This way company can offer learning route for every new commissioning engineer. It leaves all the engineers to having ability to do day to day work and it does not need to have dedicated teacher. Only times when it really needs humans touch is when there is need for update or modified old training manuals or assignments. This type of program could be sold to partners who don't have any kind of training to Rocla's vehicles and systems. Easier to follow trainees progress of students and have basic knowledge of new commissioning engineers. Next part would be to make choice between all the LMS systems.

8.1 LMS

LMS are systems where you do not need student and teachers to meet in person, but every part of the learning is done through internet. Where teacher could keep an eye on the progress of student and give similar feedback that is given through normal teaching environment through chat windows or video meetings. Of course, this type to learning takes more from student, but at the same times gives student freedom to do assignments when he or she wants to do. Only limiting factor is that work needs to be done in given time. There are some negatives sides. It takes more time to build this type of platform from scratch and that's why this documentation only investigates to premade systems in this project. That provides much easier way to add content and modify it.

LMS system that would be best suited to this application would be where the whole system is safe and secure, so that all information that is put inside of this platform stays there and doesn't find its way into open internet and has much better security of all information that is put inside the system.

Another good mark would be ease of use with minimal effort from students' side and from teachers' side whole systems needs to be easily modified so that it does not take days to have simple modification. This would made changes and modifications more effective. Third benefit would be easy to access for people who need to get inside.

Fourth benefit would be large pool of tools for creating assignment, quiz, test and other learning environmental elements like video meetings or chat rooms to support learning experience.

Fifth benefit Would be that the system needs to have ability to download many different file formats from normal txt. word excel to PowerPoints files and have way to download videos in some of the formats MP4, WMV, FLV and AVI.

8.2   Picking Best LMS

When it was looked for possible candidate to fill project needs, found large pool of different LMS system were they seem to be roughly separated into two different groups where one is free and other one is premium. Largest difference in different LMS platforms is the amount of tools for editing learning environment and security level of the website. User amount for every year for Rocla would not be massive. Right now, the amount would be around 25 or less people that would need to use this type of service User count is one of the things that need to accounted when selecting a Platforms.

Because of the limited time it was decided to look into only three different LMS systems and here are the ones that are picked for this documentation. Teachable, Litmos and Docebo. Couple things that I'm interested to look for in all these three is how to easy they are to modify, how easy it's to create new assignments, test, quizzes, how is the classified information handled in systems. And how expensive it is to use.

All the following platforms are used in free demo version and there is high chances that paid platforms have better or more tools that user can have available.

8.3   First LMS System Teachable

Teachable is the first to be looked in to on. It was surprise how easy it was to use and how clean the interface looks there was no massive logos of the company that is providing this service it was just nice and clean. Found all the necessary things for creating teaching platform. It was easy to add different file formats word, excel and power point was easy. It would to be built into platform for teaching. Monthly price structure of Teachable thus far basic version will cost 39 USA$/month, professional 99 USA$/month and

business 499 USA$/month. And in annual plans of one year in basic version is 348 USA$/Month, professional 948 USA$/month, business 4788 USA$/month. [10] Teachable dos not have any limits with how many students can use it same time. There was no mentioning about any sort of safety features or what standards Teachable is using to have classifieds information safe. Look figure 1 figure shows the overall look to the main windows of Teachable.
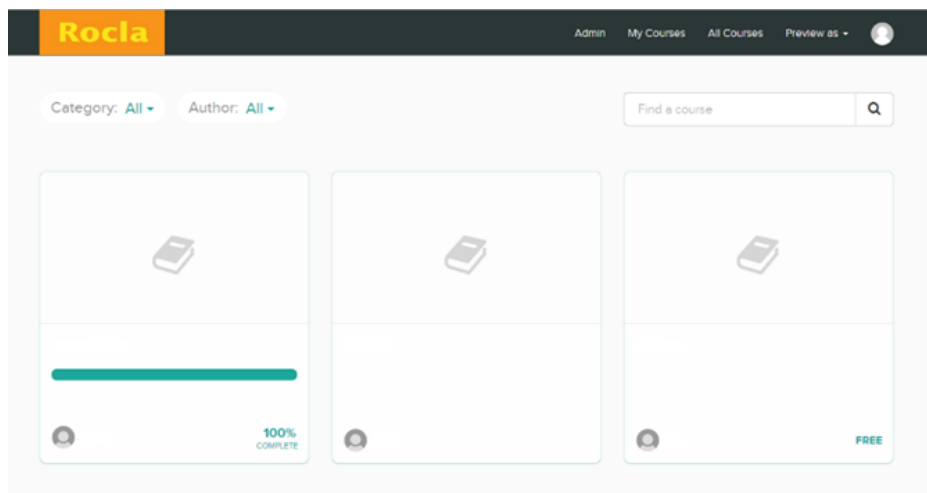
1.Teachable Home window

8.4   Second LMS System Litmos

This program would be already known inside of AGV department. It was used to make Kollmorgen web training program. Litmos as a tool to create online platform for teaching is bit more complex. And it can offer wide variation of things like direct video meeting that teachable platform doesn't have. Otherwise it gives similar tools that teachable uses to create different tests and quizzes. Has vide variation of file formats from word, excels to video formats like avi and wmv that can be added to this web site. This would make it better choice for teaching platform then teachable. It even has mention of SOC type 2 audit. Pricing structure is based on minimum of 150 users on PRO version and the price of this is 6USA$ per user/ month. And for PRO+ courses is 15USA$/month per user and min amount of users is 50. [12] Figure 2 shows the Litmos Home windows.
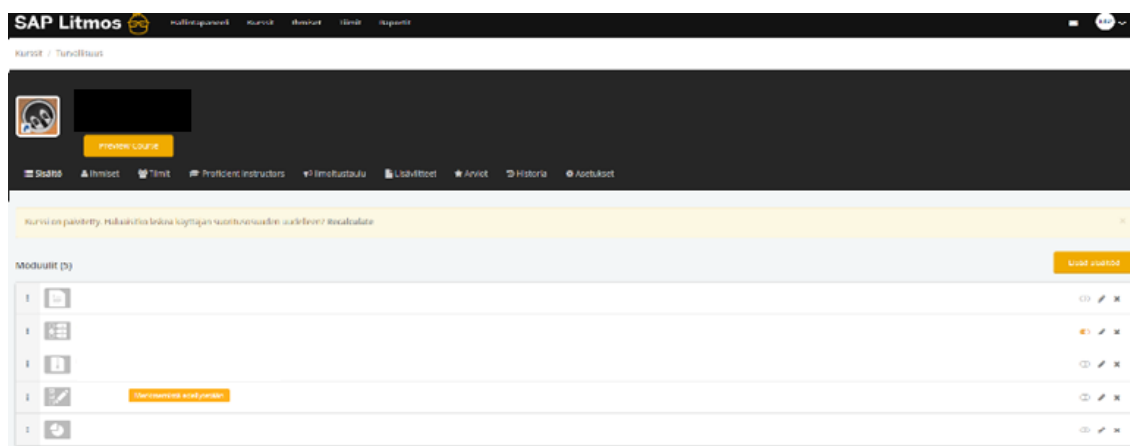
2.Sap Litmos home window

8.5   Third LMS System Docebo

This platform has same features as Litmos has when it comes to overall designing of learning platform. One thing that was found is Docebo has different when comparing security. In this platform there is SOC 2 and ISO/IEC2700 standard safety promise. Docebo pricing structure is based on how many people use it and for every user the basic account's 3.33 USA$/month for the first 300 users. [11]

8.6   Differences in SOC2 and ISO 27001

8.6.1.1   SOC 2 audit

Older name of SOC 2 is SSAE16 it was an audit system made by AICPA [5] and part of three-part family where other parts are SOC1 and SOC 3. [9] Audit looks whole company security and safe from top to bottom. Main purpose of this is to look for weaknesses that could be used to get access into company's Information by logical or physical means. [7] It's not standard or doesn't directly offer same protections or safety that following GDPR gives that is overall data protection regulation that was made by EU for similar purpose. In business worlds SOC2 still shows that the company is interested of security of data and it offers large amount of data about security problems that any given company has. [6]

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8.6.2   ISO27001 standards

International standardization organizations (ISO) purpose of this standard is to look at the information technology, Security techniques and information security management systems standard witch main purpose is to standardize data protection and it is accepted to be guidelines that follows GDPR. [8] This offers much better protection then SOC2 audit systems because company cannot get this standardization without following the set specifications that are given in ISO standards. Following ISO standard offers you and legal protection that is not given in SOC2.

8.6.3   GDPR

The general data protection regulation is EU law on data protection and privacy for all who live inside of European union and the European economic area. It addresses all data that is moving inside or outside of EU or EEU and how this data is handled. [15]

8.7   Deciding the Best Platform

After looking into all three options it is easy to see where teachable comes short and this is why it was decided to drop teachable right after not having any success of finding any mention of data protection. Looking at Litmos and Docebo, the other two systems are extremely close to each other when looking at tools and how complete of platform could be build using both platforms. Then the only solution is to look security and here Docebo offers better security because they use ISO2700 standards as and base. Rocla is company that is situated inside of Finland and Finland is part of EU. This reason alone would make Docebo better platform for Rocla's purpose. When looking price for group of less than 50 people Docebo would be the best option from all three simply because it is cheaper.

9 Dedicated training area

Having a dedicated training area is extremely import because this will give new commis-sioning engineers place to train real skills that are necessary for work situation on the field.

9.1 Ideal Dedicated Facilities

This area would be something that would only be used in training purposes it would be fully equipped to carry out all possible training scenarios. And have possibility to train with all three vehicle types ATX, ART, AWT. Warehouse for this type of purpose needs to be massive. Hall itself needs to be split into two areas one area that is used for training only and other where you can run fully working system.

Inside of this massive building, you need following solid structures. High ceiling so that the AGV can deliverer pallets to up to 18 meters. This way Rocla's engineers can train situations where max lifting heights are tested. Inside the of warehouse.

Proper area for unload and loading from various positions. Some of those positions would be ground positions (figure 3 and 5). others shelf places. (Figure 4) Tight areas where normal navigation cannot be used. (Picture 6) Somewhere inside there needs to be automated doors and ramps that can be used for training. (Figure 6) And areas where distance between vehicle and reflector is more than 25meters. (Figure 6) This area needs to have multiple positions for chargers (Figure 6) so that we can charge vehicle batteries through both ground charge station and side charging leg stations.

Reflectors both round and flat type sensor can be found from this area. Wlan network and wlan stations. System computer for running WMS, IO boxes for sensory information,

Programs: system manager, cway, layout designer, system designer. Rocla's route optimizer licenses to all programs in use. Then there needs to be way to create new routes or chances old. Bellow there is simple drawing of area talked (Figure 6). Inside of this hall the layout needs to designed way that different parts of the hall don't interrupt each other.

Figure 3. Paper rolls on the floor

Figure 4. Pallets on shelfs

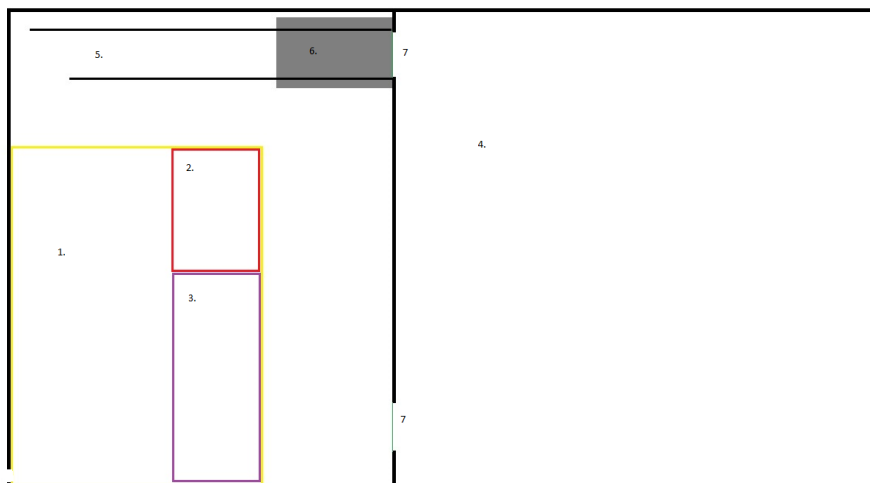**Figure 5. palets on the floor**

Figure 6. Ideal testing environment.

Explanation of Figure 6. Ideal testing environment

1. Testing and tuning area

2. Charging and Battery area

3. System's computer and Vehicle   maintenance area

4. Warehouse area.

5. Long thing corridor

6. Ramp

7. Doors

9.2 Real Training Area

Because of limitations in space and resources. There needed to be other area where physical assignments can be done. There was two locations that could be used for training facilities both of them have the basic infrastructure. Both of them are already in active use by Rocla. One is right next to assembly line in Järvenpää main offices, but this area is small, and it is already used for other purposes. Another area is situated in Vantaa and for training purpose the space is much better larger with more room. Only few of small problems one it is not ready be used by AGVs as there is still construction there and another is that its situated far of way from main offices and causes that if you are working at the Järvenpää location you need to leave it and go to other place that can take person easily 30minutes. But other vise this place could offer more space to work. More room to work makes Järvenpää location much better then Vantaa even if the distances are much longer. In Vantaa the area that would be used for training purpose is used by R&D and testing group that is the daily user of this space for now on. But it still is better for its size and over all usability then Järvenpää location.

 Vantaa area that will be designed to training purpose is 10meter times 16.2 meters. [Figure.7]

Figure 7. Real training area

For this project following items are provided to this area by Rocla

- System computer(PC) and laptop

  Inside of the system pc would be Programs: Cway visualization of layout and having ability to order vehicles; System manager is used to run the system; layout designer main purpose is to design layout and driving routes of vehicles; Diagnostic tool that with the vehicle or system; Reflector surveyor tool For measuring the reflector positions and creating reflector map, Rocla route optimizer job is to decide various things from fastest/best route to blockings for vehicles so that they don't collide and the transportation of good would be most effective.to have all the programs working and all the programs would needs to have licenses.

  System computer needs to have the following HW: CPU core count of 8 and 2.5ghrz. Memory amount of 16gb and Hard drive size of 512 gb or higher.

- Reflector

  There are two types of reflectors round that are basically and pipe with light reflecting material top of it and flat reflectors that work same way as the round with only single flat side of reflecting surface.

- Battery charge station

  Automatic battery charge station thru side mounted charge leg or directly connected battery charger

- Shelfs for Unloading and Loading

  Shelfs for loading and loading purposes. Shelfs would have a multi-level positions to up to 3 positions in height direction and the highest position would be around 3 meter high.

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- AGV

  AGV for this training would be and ATX12 It would only have and upper front sick scanner and blues spot as a specialized option.

- I/O box

  This would have input and output from PLC

- Wlan for AGVs and users

  The whole area needs to have wlan coverage with main wlan station and two extra stations to cover whole area with good internet. This network is used by vehicles and I/O information to system.

For the Assignments There was need to create one small item. This piece is mode from two pieces of wood that are separated with 3 screws and this would create object that is shown below. It only has one purpose and it is to help when tuning front sick 3000 safety scanners [Figure 8]
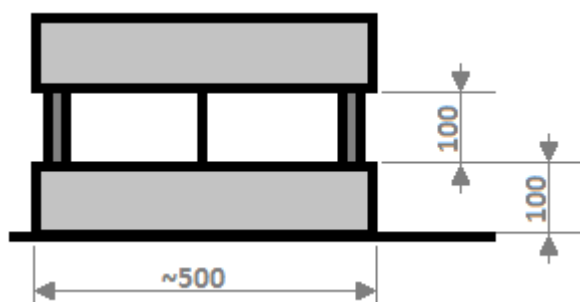

Figure 8. Safety scanner physical tune object

10 Gathering Old Material and Rewriting

So far in this thesis it is decided witch platform information can be stored and given to the new commissioning engineer (Docebo), Place where the physical part of the training can be done (Vantaa). Next part will be to go through all the old material and start collecting parts that are necessary for new commissioning engineers. This was slow process the reason being that the documentation so far has been in multiple places and haven't been in one single place where all guides and manuals are. Some of the manuals are in ATON. Some in intranet others can be found in in different folders from multiple network drives. It toke good while to process all this go around and look for all the different part and deciding which part would be necessary for new commissioning engineers to learn.

After some research of what parts would be the most important it was decided that at the start there will be needs for 11 different parts.1. Basics; 2. Encoders; 3.PPA; 4. LHU, 5. Reflectors,6, Layout and Rocla Route Optimizer; 7. Stop testing and safety fields;8. System PC; 9. I/O; 10. Wlan/IP; 11. Battery and charge station. Next part was to start plan and rewrite many of the old documentation into English and same time update them in to current information. On the Assignments chapter they will be explained in more detail.

11 Assignments

Every part will have assignments that would be able to be done alone in dedicated training area, or quiz and tests that are connected to assignments. And they would be filled in LMS system. After completing all the parts from this assignment's documents. Senior engineer could check it and give extra work or then accept the results and send engineer to site. And this way new commissioning engineer should have necessary information to work mostly independently in commissioning duties.

11.1 Basics

First part of the basic would be to give every new commissioning engineer modified key user training that every key user has to take before working with AGVs and it would go through many different subjects:

- Safety when working around AGV

- Different safety mechanism and systems of AGVs

- What is the purpose of different features and parts?

- How to control AGV In Manual mode

- Where is the back side of the AGV and where is the front?

- How to insert vehicle into systems

- How to turn on and off vehicle

- Overall picture of AGV systems and how the different parts work together

After previous points the new engineer would have an overall picture of vehicle and understand what everything does. after this new commissioning engineer would be able to say what every part does in the vehicle and have ability to use manual mode to control carrier. And after this part we will start to move on the much harder parts that go much deeper into carries functions and the systems.

11.2 Encoders

Part two is where new commissioning engineer would start to tune vehicle into the condition where it can be trusted that carrier is able to drive straight and the distance that carrier drives is same in software as in real world. Learn more deeply about carries encoders. Drive and steer encoders and after this part engineer has better knowledge of encodes.

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11.3 PPA

Similar as Previous part we go more deeply into subject and this time it is PPA and laser navigation. This is Highly important because vehicle will be driving without any human supervision.

11.4 LHU

This part is about all about LHU unit and main focus is going to be in weight, Lift speeds lowering speed, heights, and max lifting capacity tune and testing. After part four we have working vehicle. Next part would concentrate to all the system that make AGVs work automatically warehouses.

11.5 Reflectors and Area

This part would be all about Reflectors and about the area where reflectors need to be installed and how to create reflector map.

11.6 Layout and Rocla Route Optimizer

Next part would be about layout, Rocla route optimizer and AutoCAD all the assignments would be about various chances to layout and how to simulate it with Rocla's software or how to upload it into real vehicle and to system.

11.7 Stop Testing and Fields

How to do proper stop test and chance safety fields from CDS and flex software. Purpose of this assignment is to be certain that carrier is safe for humans around it and other vehicles in same space.

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11.8 Future

Because of the given time for this project was not enough to finish all the assignments it was decided to cut at this point and next four parts of the assignments need to be left undone. They will be done in later time.

11.8.1 System PC

What programs are needed and how to install all necessary programs.? How to choose right PC for this job so that it has right amount of power in CPU, memory and drive space.

11.8.2 .IO

How IOs work and how to add new ones.? Example would be to make automatic door work with AGVs

11.8.3 Wlan / IP

This part would tell how to install and make network into working condition and same time have deeper knowledge of networks and why it is needed in AGV systems.

11.8.4 Battery Charge Stations and Battery Configurations

How to install and configure battery system so that it will work automatically and what type of information would system need from battery's chargers.?

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12 Conclusion

Before of this thesis was even started. It was decided that Rocla needs to have a better system for teaching new commissioning engineers. Something that would be more effective and much faster what is in use right now. At this documentation I have gone through problem points and addressed them by giving solution for them. What I have found is that there needs to be a single place where all the necessary information can be found, and all this information needs to be in form that it is easy to follow. My solution for this problem was to move all the information into LMS base system where the distribution of information is easier. System will have the necessary manual for training assignments. Because some of the assignment made so that there is need for physical area it was necessary to point physical trainings area. place like this was found to be at the Vantaa hall. Having these two things in order would give Rocla new commissioning engineers much better chance learning things. Before they need to move real customer situations. And this in exchange would give much faster training period for every new commissioning engineer, better customer satisfaction and every project could move faster.

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