A Project Report

On

“END OF THE LINE PACKAGING SOLUTION WITH DELTA ROBOT AND ACOPOSTRAK USING MCR CONCEPT AND B&R AUTOMATION STUDIO”

Submitted in partial fulfillment of the requirement of

University of Mumbai for the Degree of

Bachelor of Engineering

In

Mechatronics Engineering

Submitted By

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TERNA ENGINEERING COLLEGE NERUL

UNIVERSITY OF MUMBAI

Academic Year 2021 – 22

CERTIFICATE

This is to certify that the project entitled **"End of the line packaging solution with Delta Robot and Acopostrak using MCR concept and B&R Automation Studio"** is a bonafide work of **"Vinayak Samant", "Supreet Dhayapule", "Harshad Mane" and "Suraj Bhore"** submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of **"BE"** in **"Mechatronics Engineering".**

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Date:

Place: Navi Mumbai

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

The aim of the project is to offer unique levels of machine flexibility and precision by merging robotics with machine control enabling remote access, increased efficiency and also save floor space.

Robots are an integral part of automation industry. Traditionally, robots used in machines are self-contained, with their independent controller and its control cabinet. The configuration, diagnostics and maintenance of robot are all performed using a dedicated system, with a specific robotic language. These robots have to be coordinated with the machines so that they can give the required output. This system requires dedicated controller for each machine and robot. Therefore, machine centric robot is required which has only one controller. As this robot will no longer require a dedicated controller, all interfaces between the machine and the robot are eliminated, while the fact that all axes and sensors will now communicate on a common network increases precision and speed of response. This also helps to increase the productivity of the machine and the output of the process.

In this project, a machine centric robot will be controlled for a certain process using Mapp Robotics and HMI screen will be developed for the robot. The main phase of the project will include user friendly programming of robot according to the application using Mapp Technology. Testing and debugging the robotic model on a third-party software, where the entire robot can be simulated and the program can be transferred and working of the robot can be examined.

The project will also include an advance technology from B&R Automation, called Acopostrak. It is a track conveyor kind of system which is fast and accurate. Which will be used to move objects towards processing points.

CHAPTER 1

Introduction

1.1 Background:-

In today's world, industries are transitioning to industry 4.0 principles. There is an unexpected increase in demand for manufacturing items, and one must meet the demands of the customers. After the product is made, it must be sorted according to standards before being presented to the final user in the market.

However, there is a lot of misplacement while completing the last phase, therefore it must be done in a systematic manner.

Our idea is an industry 4.0 concept in which we propose an end-of-line packaging solution with parallel processing that will eliminate the need for humans. We will automate the packaging process so that several goods may be packaged at the same time, eliminating all mistakes and saving time. This automated process will use Acopostrak and Delta robots, as well as PLCs, PCs, and PACs, as well as different industrial communication systems. We may run the procedure both manually and automatically utilizing Mapp technology.

1.2 Motivation: -

The digital revolution has already changed how people live, work, and communicate. And it’s only just getting started. But the same technologies that have the potential to help billions of people live happier, healthier, and more productive lives are also creating new challenges for citizens and governments around the world.

With rapid development in artificial intelligence (AI) and robotics technology, automation is at a tipping point. Today, robots can perform a slew of functions without considerable human intervention. Automated technologies are not only executing iterative tasks, but also augmenting workforce capabilities significantly.

As we can see the automation industry is growing rapidly and in future it will be in huge demand, so in order to explore this growing technology we developed our interest in this particular field.

In fact, automated machines are expected to replace almost half of the global workforce. Multiple industries, from manufacturing to banking, are adopting automation to drive productivity, safety, profitability, and quality.

So, to cope up with developing Automation Industry we developed our interest in this particular topic.

1.3 Problem Statement: -

The aim of the project is to develop a Machine centric Delta Robot along with Acopostrak (A smart conveyor technology) for part picking and part handling operations as an end of the line packaging solution. The project also includes development of user friendly acopostrak which will be used to control all the machining operations.

1.4 Scope and Goal: -

Our project is a simulation of the actual machine which can be used for all of the above problems. Goal of our project is to make a working model which can work properly with acceptable accuracy. Which can be used in various industries such packaging, food, assembly. The project can easily feed into real hardware. A simple modification in the code lead to various different useful outcomes. Also, the project includes mapp functionalities for smooth and user-friendly handling.

1.5 Objectives: -

1) Building Delta Robots for object handling.
2) Developing ACOPOSTRAK
3) Developing HMI screen for controlling operations
4) Including Mapp functionalities

1.6 Organization of the report: -

Chapter 1 includes the introduction of the report. It describes basically what a overall system is and how we intent to use it to solve industrial problems.

Chapter 2 is all about the Literature survey we have done. It includes brief description of all the research and technical papers we have referred and well as some information about the existing system similar to ours.

Chapter 3 is Methodology. Here, we have included the basic principles and methods that would be useful to us to implement our project.

Chapter 4 is Design and Implementation. Here we have shown the block diagrams of our system, calculations and implementations snapshots.

Chapter 5 is Applications and Future scope. Here we have listed down some applications where our system could be employed. In future scope, we have listed various ways in which our system could be enhanced so that to achieve more functionality

Chapter 6 is Conclusion, where we conclude our project as well as mention our project's progress in the given time frame

CHAPTER 2

Literature Survey

2.1 Literature Survey:-

Sr no.	Author	Publication	Paper title and investigations	Findings
1	XIN-JUN LIU, JINSONG WANG, KUN-KU OH and JONGWON KIM	Journal of Intelligent and Robotic Systems	Title- A New Approach to the Design of a DELTA Robot with a Desired Workspace. Investigation-In this paper, a new design method considering a desired workspace and swing range of spherical joints of a DELTA robot is presented.	This paper concerns a new approach to the design of a DELTA robot with a desired workspace. The method is based on a new concept, the maximum inscribed workspace, proposed in this paper.
2	Florian Pauker, Iman Ayatollahi, Burkhard Kittl	Institute of Research Engineers and Doctors, USA	Title- OPC UA for machine tending industrial robots - Prototypic development of an OPC UA server for ABB industrial robots. Investigation- Concept of OPC UA	In this paper an information model and a prototype of OPC UA server using this model for data acquisition, event generation and remote control of a machine tending industrial robot is described.
3	MICHAEL LOUIS PAULY	Rose-Hulman Institute of Technology	Title- Workspace Analysis of a Linear Delta Robot: Calculating the Inscribed Radius. Investigation- This study demonstrates the relationship between the LDR's (Linear Delta Robot) physical dimensions and the inscribed radius of its work envelope.	This study used a single LDR as a reality check, and while the physical model roughly matched the equations, a single data point does not prove a trend. While this study focused on the inverse kinematics to find unreachable points, a robot's Jacobian matrix can also be used to find limits or singularities.
4	Vjekoslav	29th daaam	Title- Modelling and	The paper presents

Sr no.	Author	Publication	Paper title and investigations	Findings
	Damic, Maida Cohodar & Avdo Voloder	international symposium on intelligent manufacturing and automation	Path Planning Of Delta Parallel Robot In Virtual Environment. Investigation- The paper presents an approach to path planning of industrial robot based on the exchanging the signals between its virtual geometric and kinematic models. The proposed approach is applied to an example of parallel robot ABB IRB 360 in a working environment.	approach for task planning of the robot system, based on collaboration between two robot models: the kinematic and the virtual. Models are developed using two different software packages and run-in different windows during simulation.

2.2 Existing System: -

In order to connect the Robot to Machine, Interfacing is performed. The machine interface is the communication between the robot cell and the machine. Various signals go back and forth. For example, placing an object on conveyor belt, adding other object onto existing objects on conveyor belt or other things that are important for the communication between the robot and the machine about the automated results.

Traditionally, robots used in machines are self-contained, with their independent controller and its control cabinet. The configuration, diagnostics and maintenance of robot are all performed using a dedicated system, with a specific robotic language. These robots have to be coordinated with the machines so that they can give the required output. This system requires dedicated controller for each machine and robot. Which will eventually increase the cost of the project and processing time.

CHAPTER 3

Methodology

3.1 System Overview: -

Our proposed system will consist of following sub systems. All of these systems are combined to make machine.

1. Machine Centric Delta Robot
    a. Frame
    b. Stepper Motor
    c. Motor Drive
    d. End Effector
2. ACOPOStrak
    a. Shuttles
    b. Stator
3. Main Controller Umit
4. OPC-UA
5. HMI screen
6. Mapp Technology
    a. Mapp UserX
    b. Mapp AlarmX
    c. Mapp Audit
    d. Mapp Recipe
    e. Mapp Data
    f. Mapp File

3.2 Machine Centric Delta Robot: -

Machine centric robotics is the concept in which the controller/PLC used for machine will also control the Robot, which will eliminate the cost of the process and all the interfaces between machine and robot will also be eliminated.

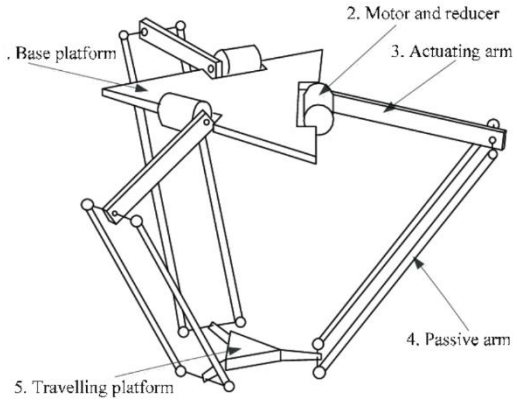
A Delta Robot is a type of Robot that consists of three arms connected to base platform. It is also called as parallel robot as Travelling platform always moves parallel to the Base platform.

Machine Centric Delta Robot works similar to the original delta but it is controlled by Controller of the Machine. All robotic operations remains the same.

a. Frame: -

The frame of the Delta Robots includes Base platform, Moving Platform and connecting arms. Base platform is fixed at the top. Motors and connecting arms are attached to the base platform.

Moving Platform is a platform to which end effector is connected. The two platforms are connected with two different links/arms i.e. actuating arm and passive arm.



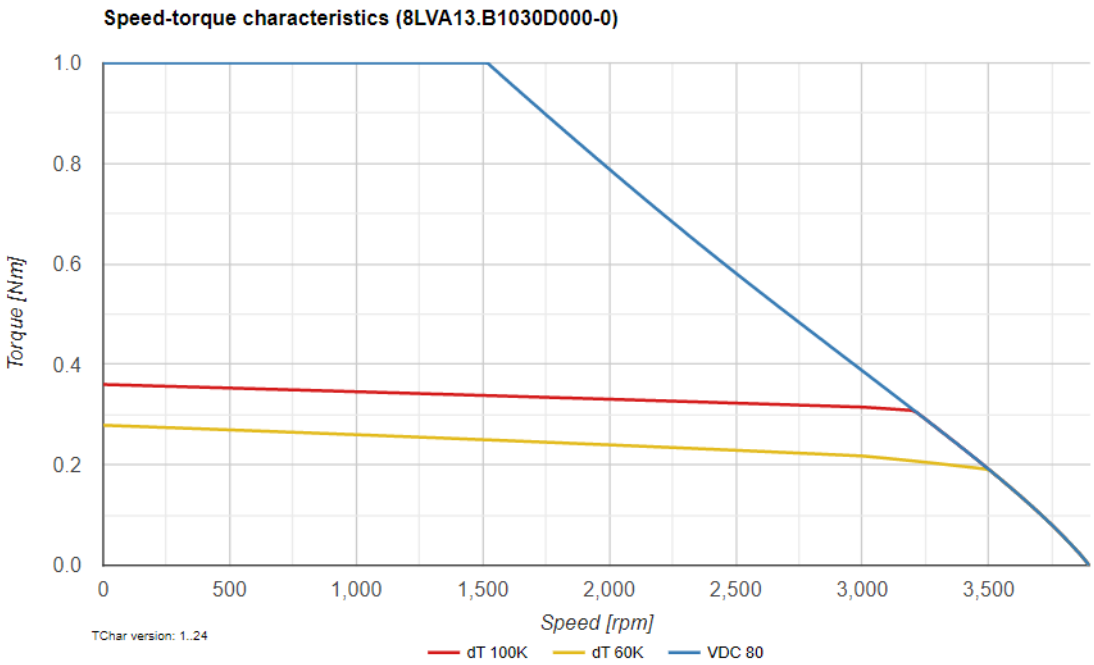
b. Stepper Motor: -

Stepper Motor is a Brushless, Synchronous DC motor full rotation of rotor is obtained in equal number of steps. Even though the motor is open loop, motor position can be controlled accurately.

For our project we have selected **8LVA13.D1030D000-0a** motor. There are four such motors used in order to control single Delta robot. 3 motors are used to control three different delta axes. Fourth motor is there for future applications.

The motor has following specifications-

Nominal Speed	-	3000rpm
Nominal Torque	-	0.32Nm
Nominal Power	-	101W
Nominal Current	-	1.4A
Stall Torque	-	0.36Nm
Stall Current	-	1.6A
Max. Torque	-	1Nm
Max. Speed	-	6600rpm
Protection Class	-	IP54
Supply	-	80vDC



Speed rated: 3000 rpm, Torque rated: 0.320 Nm

c. Motor Drive:-

A motor drive controls the speed, torque, direction, and resulting horsepower of a motor. Dc drives typically control a shunt-wound dc motor, which has separate armature and field circuits. Ac drives control ac-induction motors and, like their dc counterparts, control speed, torque, and horsepower. For our project we have used 80VD100PD.C000-01 motor drive

DESCRIPTION:

- Control for 2 motors
- 2 EnDat 2.2 interfaces
- Motor connector: 24 to 64 VDC ±25%, nominal 8 ARMS (maximum 10.6 ARMS)

- Switching frequency: 5, 10 or 20 kHz
- Complete integration in Automation Studio and CNC applications
- Operation using PLCopen function blocks
- 2 trigger inputs
- Motor holding brake connection
- Enable input

2x EnDat 2.2, 24-64 VDC, 25% power supply, 2 motor connections, 8 A continuous current, 2 digital inputs 24 VDC, sink, may be used as trigger inputs, 1 digital output 24 VDC, 1 A, buy terminal blocks and encoder backup battery 80XB120A2.36-00 separately!

d. End Effector:-

End effector is part in the robotic system which is installed on the wrist of the robot. End effector is important part as it is used to perform the operation which robot is intended to do.

3.3 ACOPOStrak:-

Real Hardware view of Acopostrak

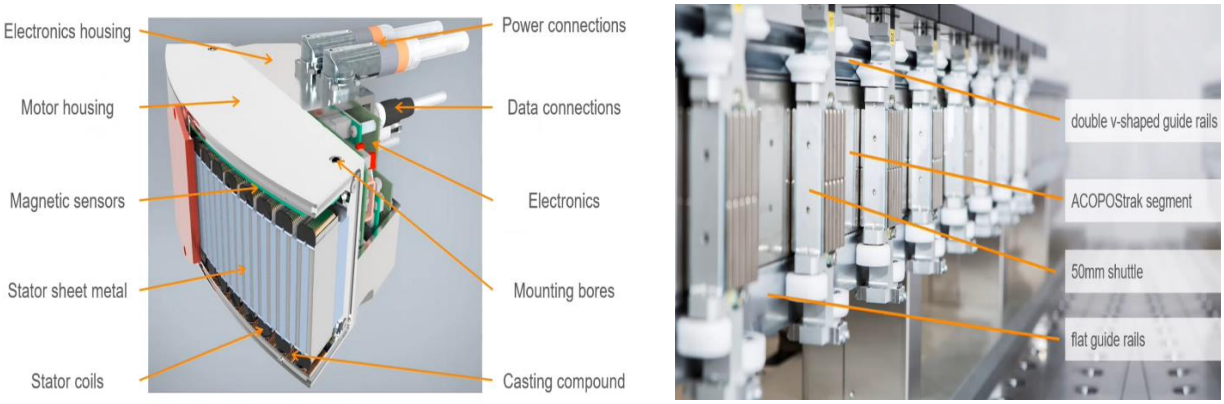
ACOPOStrak system is a high speed conveyor technology whose working is similar to the linear motor. It is used to transfer product at very speed.

Automatic collision avoidance, diverter control and adding/removing shuttle s are some of the features that make this system so simple**.**

There are two main components i.e. Shuttle & Stator. Shuttle is a permanent magnet and Stator is electro-magnet with 3 phase supply. It has consecutive coils which are connected in series. There are four different stator

segments available through which different shaped acopostrak system can be obtained. Shuttle moves on Acopostrak due to repulsive action formed between 2 magnets

Each motor coil is actuated by a dedicated driver. There is a current control loop for each motor coil. Shuttle positions on the track are sensed with magnetic sensors. There are Position and speed control loops for each shuttle for full control of the shuttles on the track.



Cross-sectional View of Stator and Shuttles

3.4 MAIN CONTROLLER UNIT-

a. Main CPU 5PC910.SX02-00

The APC910 uses modular accessory components such interface modules and mass storage devices (hard drive, SSD, CFast card) to make stock management more easier. It is not required to make constant changes to the PC hardware over time, which has its own economic benefits.

The Automation PC 910 supports a wide choice of CPUs to give optimum processing capacity for the most demanding jobs. They're based on Intel's Core i-series CPUs, which are the gold standard for high-performance PC systems. The chip's size has been lowered to a remarkable 14 nanometres. In comparison to earlier generations of Core I CPUs, a new microarchitecture with the graphics unit integrated directly in the CPU gives a significant performance boost.

b. BUS CONTROLLER

The bus controller allows X2X Link I/O nodes to be connected to POWERLINK. A prescaler can also be used to operate the X2X Link cycle synchronously 1:1 or synchronous to POWERLINK.

POWERLINK is a Fast Ethernet standard protocol with strong real-time properties. The POWERLINK Standardization Group (EPSG) ensures that the standard is kept available and updated.

In our project we have used X20BC8083 bus controller

In addition to the bus controller, the bus modules enlarged to the left allow for the installation of up to two hub expansion modules. There are two RJ45 ports on each extension module. As a result, a simple device may support up to six hub connections.

c. Hub Expansion Module

It is as expansion module for the bus controller which provides additional slots to connect more number of motors. We have used 2 **X20HB2880** hub expansion modules in our project. Depending on the bus base, an extra 1 or 2 places are available. In these slots, the X20HB2880 hub expansion module can be used. LEDs display the status of the module and network.

d. The Supply module

The power supply module is the power house that energizes the PLC to carry out its function. The power supply module converts the input source power into signal level voltage used by the PLC processor and other modules.

The supply module is used together with an X20 bus controller. It is equipped with a feed for the bus controller, the X2X Link and the internal I/O supply. We have used X20PS9400 module.

Module performs following functions-

- Supply for the bus controller, X2X Link and internal I/O supply
- Redundancy of bus controller / X2X Link supply possible by operating multiple supply modules simultaneously

3.5 OPC-UA: -

OPC stands for Open Platform Communications United Architecture. It is used in the Industrial Automation system for machine-to-machine communication. It is a standardize interface between PLC drivers and HMI. It is used for information exchange for industrial communication.

It requires client and server machines. With using OPC-UA data can be transferred from one software to another or from one operating system to another. Due to these kind of features OPC-UA is used in various industries such as automobile, food & beverages, oil & gas, energy & utilities, packaging and so on.

In our project we have used OPC-UA for connecting Delta robot, Acopostrak & HMI.

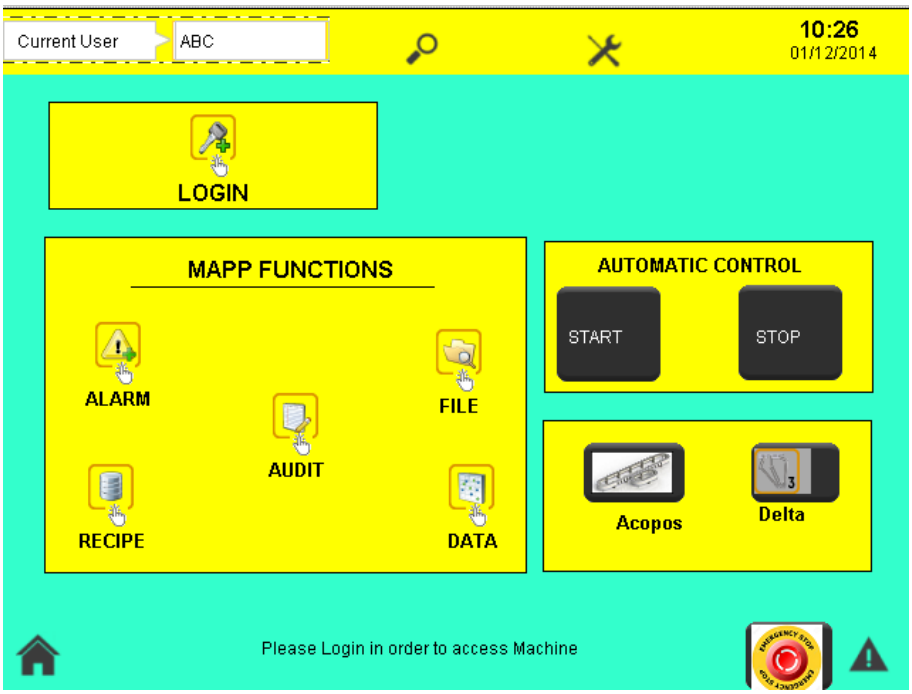
3.6 HMI Screen:-

HMI stands for Human Machine Interface. Now a days HMI can be seen on various industrial locations such as portable handheld devices, on machines, centralised control rooms. It provides graphical user interface with input/output commands to monitor and operate the machinery. HMI screen can perform functions such as providing real time feedback, setting alarm and modification in the system without changing the program. Through HMI we can operate the system and have a track on process parameters.

In our project we have added the HMI screen which is having 640x480 resolution and 32-bit colour configuration. The orientation of the HMI is landscape.

Inside the HMI we have added the pages to control Delta robots & Acopostrak. The control operations for the robot includes Power on off commands, Home and Move robot command. HMI includes the section through we can get accurate positioning of the robot i.e., co-ordinates of the robot's wrist position. Also, there is provision to move the robot in single axis through HMI. The controls for the Acopostrak includes Power on off, shuttles Start and Stop, Barrier command on and off. HMI also has several MAPP functionalities which are used to get to know the system functioning deeply.

We also have included the automatic control for the process. By pressing Cycle start button all the process will start to operate by its own. There is also the provision for Emergency stop command by which process will stop at that point.

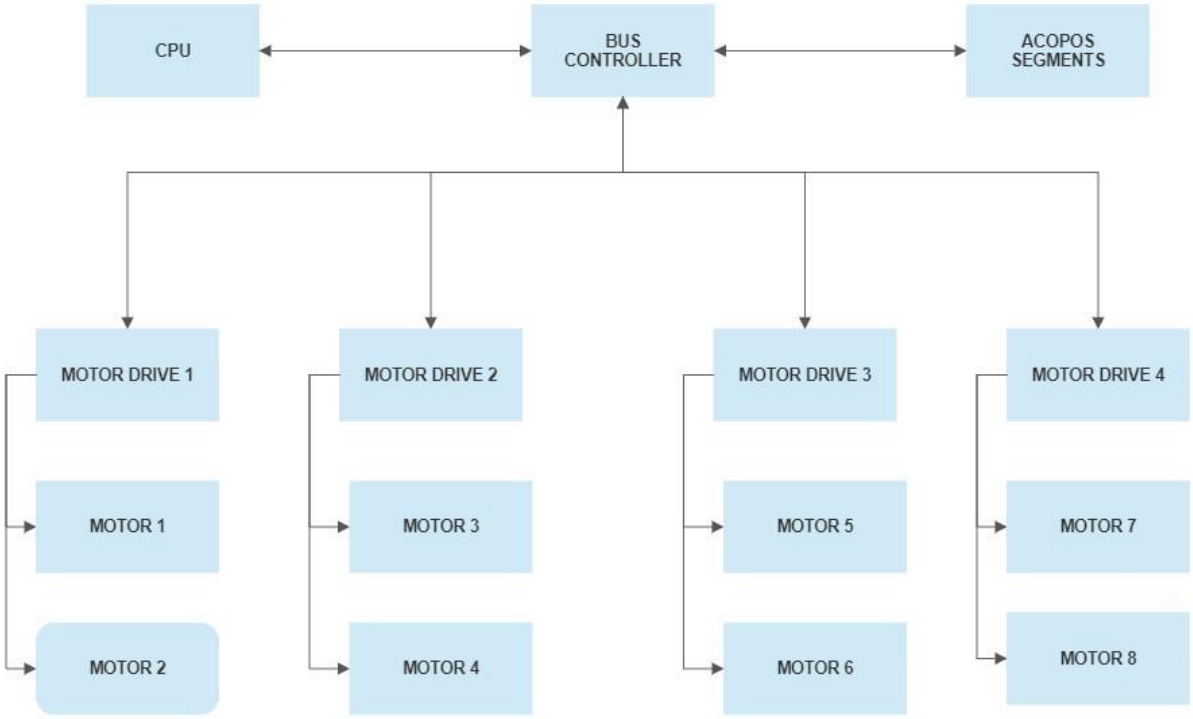


3.7 Mapp Technology: -

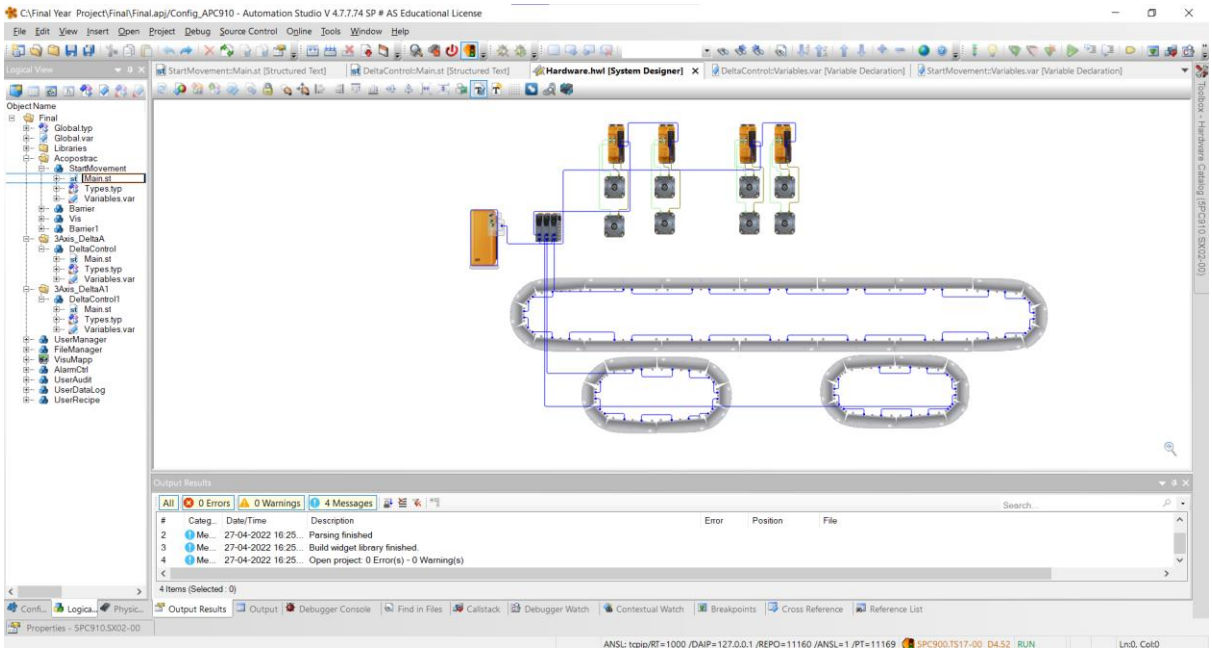
Mapp is B&R's application framework. Mapp technology provides set of tools and services which allows to create software for all types of industrial machinery and equipment's. There is wide array of Mapp components which provides certain function. Each component is identified by their unique Mapp link. Mapp technology is also organized in areas of motion control, machine infrastructure, HMI and Safety technology.

In our project we have implemented following map components like Mapp UserX, Mapp Alarm X, Mapp Audit, Mapp Recipe, Mapp Data & Mapp File.

3.8 System Block Diagram:-



Hardware Configuration: -



3.9 Software Used:-

Automation Studio:-

Automation studio is single software for every aspect of any automation project. It minimizes training needs, solidifies overall integration, and eliminates communication problems between engineering disciplines. Automation Studio provides us with various kind of programming language to be used according to our needs, like ANSI C/C++ known as structured text (ST),Ladder Diagram (LD) programming, Automation Basics (AB), etc.

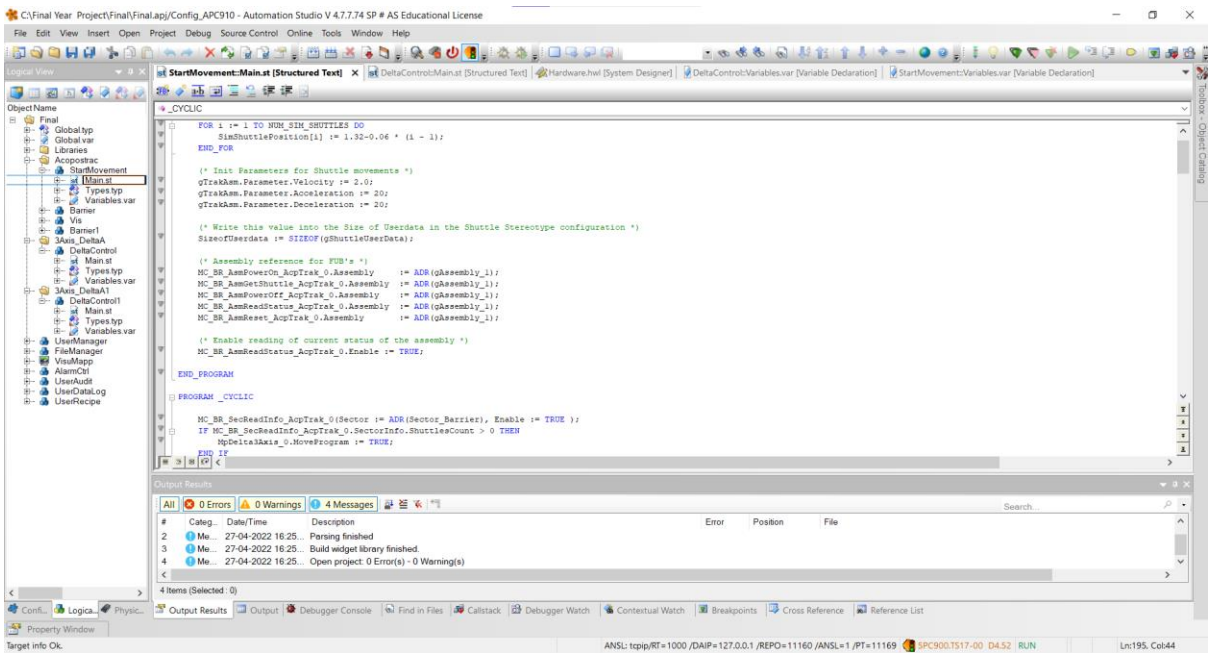
Automation studio gives us different types of hardware, both real time (PLC) and simulation purpose (PC) hardware. It provides us with full customizable control of hardware in configuration part.

Automation studio has played crucial role in our project. By using automation studio, we have created configured and programmed the delta robots and acopostrak. By using visualization function in automation studio, we have created HMI layout.

Mapp Template is provided in automation studio, which connects to Mapp technology. Mapp is B&R's application framework; it provides us with

highly efficient set of tools and features that allows us to create Automation software for all types of industrial machinery and equipment in fraction of time.

Automation studio has different kinds of output windows which are used to show status of the operation. There are three main views in automation studio i.e. Logical view, Configuration view and physical view. Logical view is used for the programming. In physical view all the hardwre components are added. Configuration view is used for the configuring different hardware.

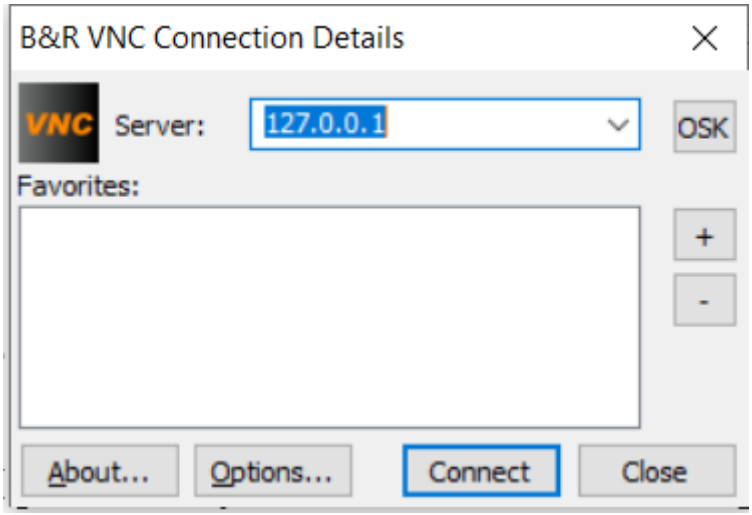


VNC Viewer

VNC viewer is remote administration software, it used to control the devices, files, alarms, machinery, etc. With vnc viewer we can simulate HMI screen.

Using the HMI provided by automation studio and map technology, we are able to view the software created by using Mapp components and access it.

All types of user control like logging in/out, creating/deleting user, viewing information on any user, controlling alarm, handling files and events, etc. are viewed on VNC viewer.



Special features of the VNC

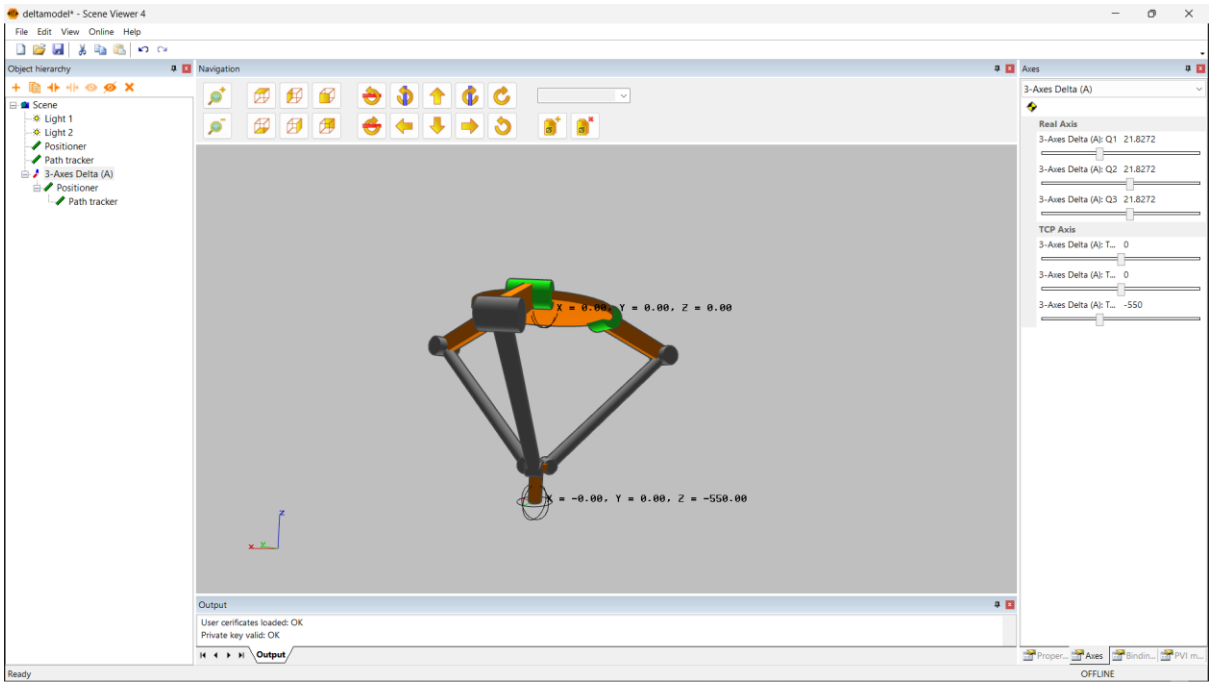
- Auto-connect: Automatically connects to the last valid point/task at start-up & logging to server on lost connection.
- Auto-login: Pre-set password for logging onto the server beforehand.
- "Background" mode for using the viewer as a Windows shell
- Disconnect key: Closing the connection by pressing a certain key.
- RFB protocol extension for transferring matrix keys and LEDs from B&R devices as well as executing additional functions, e.g., starting a process on the client from the server.

Scene Viewer

Scene Viewer is B&R's Modelling software or 3D visualization tool. All type of designing & development of hardware like delta robot, CNC and Acopostrak are done in scene viewer.

The software provides ready-made models but also allows you to create your own objects. It helps us to understand alignment and positioning of the model. The position values (e.g., joint axes) required by the controller are transferred to it via PVI and OPC-UA. Once received, this position data causes the object in the Scene View to move for illustration purposes. Inside the Scene viewer there are functions like positioner, path tracker through we can get real time position of object.

Through scene viewer, we can simulate Delta robots and Acopostrak by manually moving it through various options. VNC viewer is connected to automation studio via ip address.



In order to simulate our project, we have combined above three software.

CHAPTER 4

Implementation

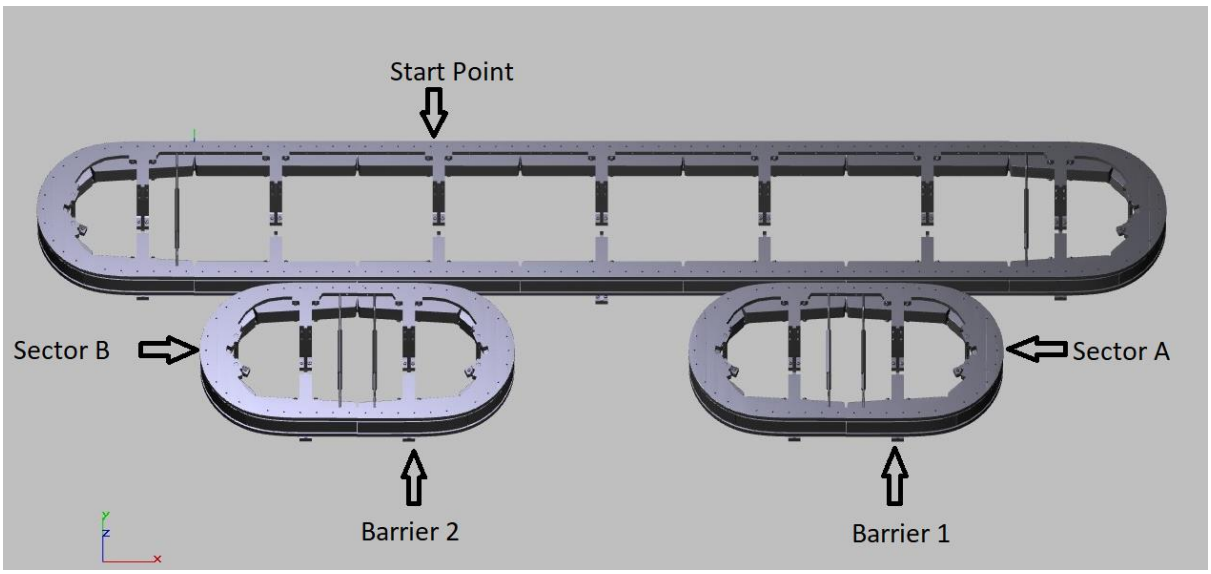
4.1 Overview of Implementation:-

We started by building the Acopostrak, then built delta three-axis robot according to the requested configuration. The next stage was to position the two delta robots at the pickup location, in addition to the acopostrak. We controlled the delta robot using structured text code. We defined the delta robot's locations and it moved appropriately. Then, with the aid of structed text, we sorted the products on the acopostrak.

Then, using Mapp technology, we created an HMI interface for it, allowing the user to run the system manually or automatically, as desired. We've specified user controls, login history, and the modes in which both systems will operate in order to deliver maximum productivity in the shortest amount of time.

4.2 Configuring Acopostrak System:-

Acopostrak system includes one big and two small oval shaped loops. Shuttles move over these loops. These three loops are divided into two sectors A & B. Big oval is common in both the sectors. Two different sectors are been used for parallel processing of the machine.

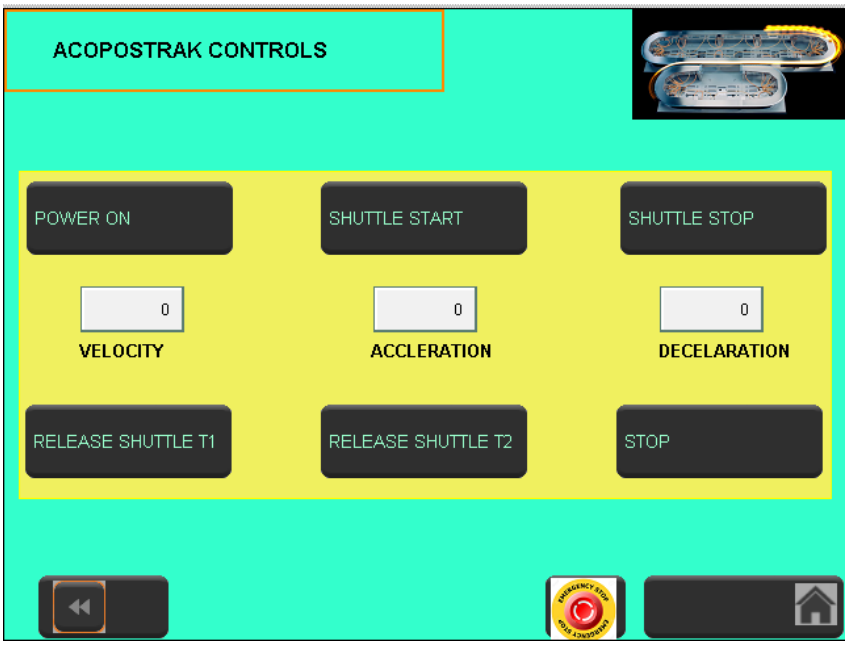


Acopostrak View

We have programmed the Acopostrak in such a way that, odd numbered shuttles go into Sector A and even numbered shuttles go into Sector B. At each sector there are barriers. Barriers are used to stop shuttles at specific point from on the sector. All the shuttles stops on the barrier area.

As shuttles stop on the barrier, the signal is given to robots to move. After robot's processing, one shuttle is released from the barrier. That shuttle again goes to the initial position. And the process is continued until stop button is pressed.

We have added the commands on HMI screen to control movement of shuttles on Acopostrak. The commands include Power on, Shuttle Start, Shuttle stop. Power on used to power on the Acopostrak system. Shuttle start is used to move shuttles on the Acopstrak. By using shuttle stop button, initially first shuttle is stopped and then remaining shuttles stop behind the first shuttle. There are also options to monitor and control Speed, Acceleration and Deceleration of the shuttles. There is another option for stopping the shuttles on the track. By using it all the shuttles stop at their respective positions. In the HMI there is also provision to release the shuttle manually.



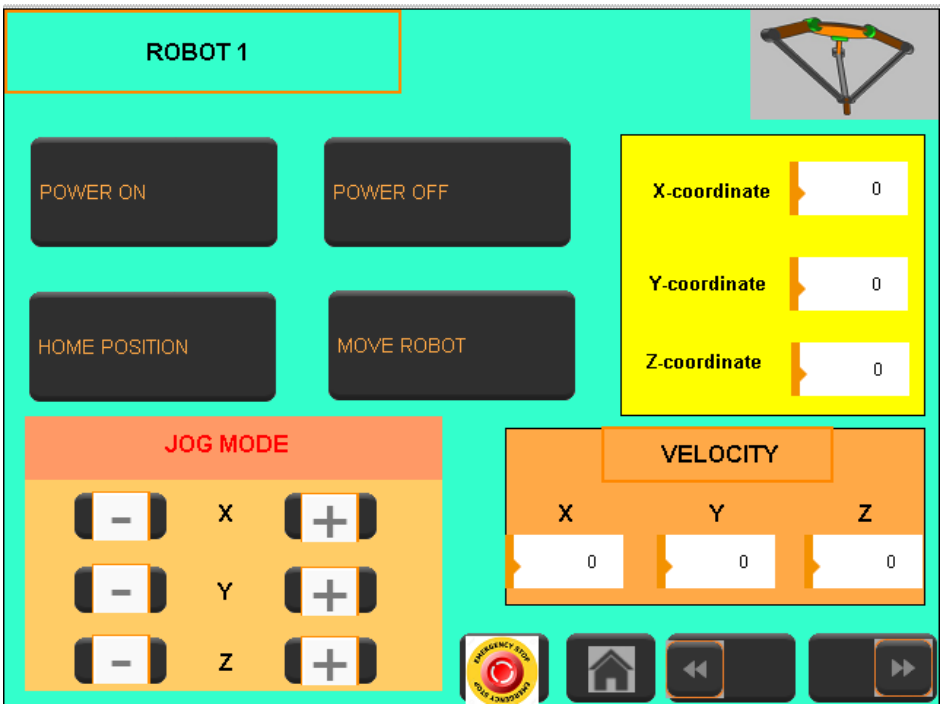
Acopostrak Controls

4.3 Delta Robotic System:-

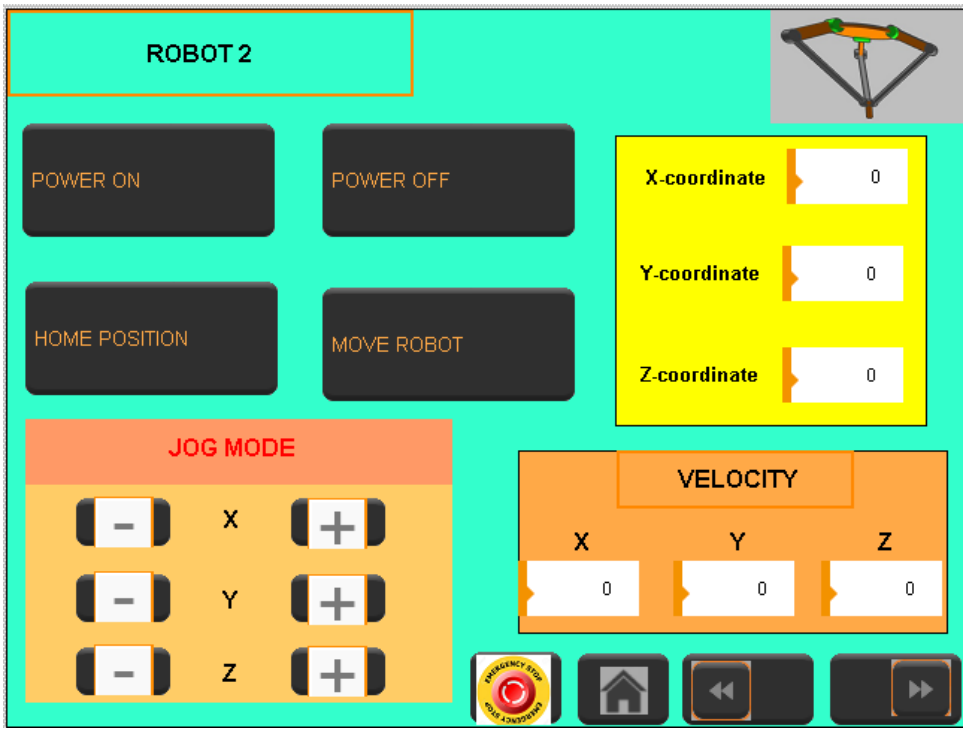
The two delta robots are placed over the barrier positions over the Acopostrak. The program to move the Delta robots is saved in the external memory. In that program we have first defined the co-ordinates of positions to which robot will move. Then that program is called by the main controller program which is written in structed text language. Every time there is command to move the robot, program from external memory runs. As soon as barrier detects the stop movement of the shuttle, the signal is sent to robot to move the program.

```
VAR CONSTANT
   P1 : McPointType := (Pos:=(X:=0, Y:=0, Z:=-650));
   P2 : McPointType := (Pos:=(X:=-50, Y:=-20, Z:=-600));
   P0 : McPointType := (Pos:=(X:=0, Y:=0, Z:=-560));
END_VAR

PROGRAM _MAIN
 Feedrate(5000);   //move with reduced speed
 MoveJ(P1);        //move system to point P1
MoveJ(P2);        //move system to point P2

 WaitTime(3);        //wait for 3 seconds

 MoveJ(P0);        //move back to origin position
END_PROGRAM
```

On the HMI there are various options to control both the robots. That includes Power on, Power off, Home, Move robot options. Power on and off are regular commands for turning robot on and off. By pressing home, robot will move to its home position. After homing robot cannot be moved manually or by using hands. Move Program is used to move the robot according to program stored in the external memory. Without Power on and Home robot program will not move. The HMI also includes Jog mode which is used to move the robot in the single axis. There is output window which will indicate co-ordinates of robot wrist.



Robot 1 Controls

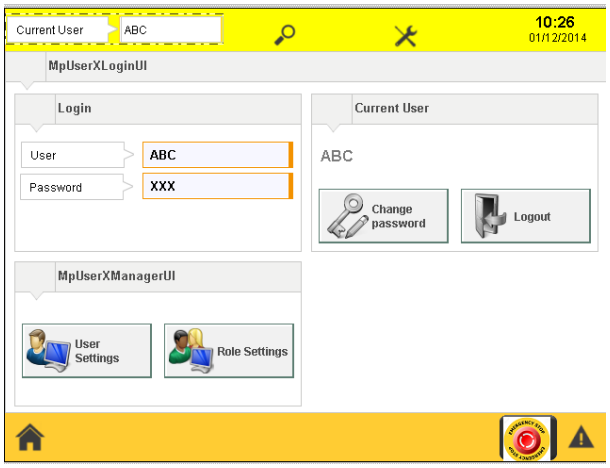


Robot 2 Controls

4.4 Mapp Technology:-

a. Mapp UserX: -

To set up user management in HMI, Mapp UserX is used. It performs basic functions of LOG IN/OUT via HMI applications and is able to easily configure my users and user groups. Without authorized

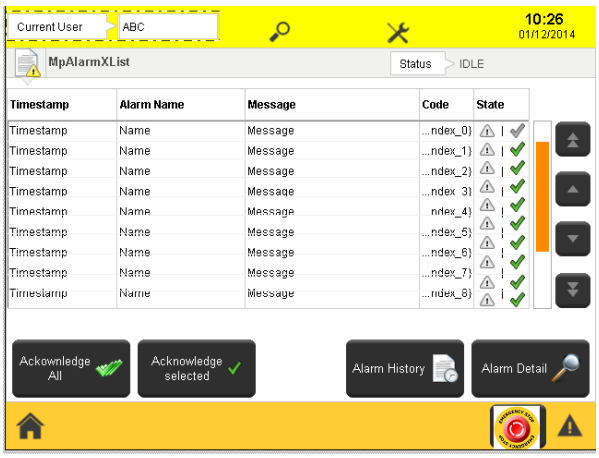


login credentials no one can access any part of the HMI screen or can start he machine. UserX prevents access to my machine by third parties. Only authorized personnel will be able to operate my machine. It also allows us to add, block and delete users. UserX provides us with editable different user roles.

b. Mapp AlarmX :-

AlarmX is used to create and connect various types of alarms for indication of any alert of any kind of situation.

Alarmx provides us informative and simple alarm message in our own language, it helps us acknowledge the internal alarm system used by mapp.



Levels of alarms can be identified by user from high to low as they are being displayed. AlarmX also provides detail information about error (i.e., error code) if occurred. AlarmX also comes with different function blocks which provides detailed history of alarms occurred at that time.

In our system we have added Alarm condition for temperature control.

c. Mapp Audit :-

Audit is used to record any kind of event occurred on the system. This includes OPC UA events, value changes, actions on the HMI system, user management actions, etc. We are able to generate an event at any time. Audit provides the function of exporting file(.pdf/.csv) so the data cannot be manipulated or can be shared with anyone. All events are been archived**.**

d. Mapp Recipe :-

Mapp Recipe helps us to save recipe parameters to different recipes and load them from different recipes as well. Able to assign my parameters to different recipes using different categories (PID control, machine parameters, etc.). Able to manage recipes on a storage medium in a tamper-resistant manner. Helps us to manage and use various recipes.
With mapp recipes we able to easily modify and save recipes.

e. Mapp Data :-

Mapp Data provides the option of logging production data and the ability to process it further. With this we can retain data even in the event of a power failure.

We are able to log different process variables to gain insight into the behavior of the machine and able to generate entries based on different triggers. Triggers can include a change in value, a user-defined trigger or even a periodic trigger. Helps us to log structures and arrays without extra work. We are able to decide how data is logged (e.g., in CSV files or an internal ring buffer).

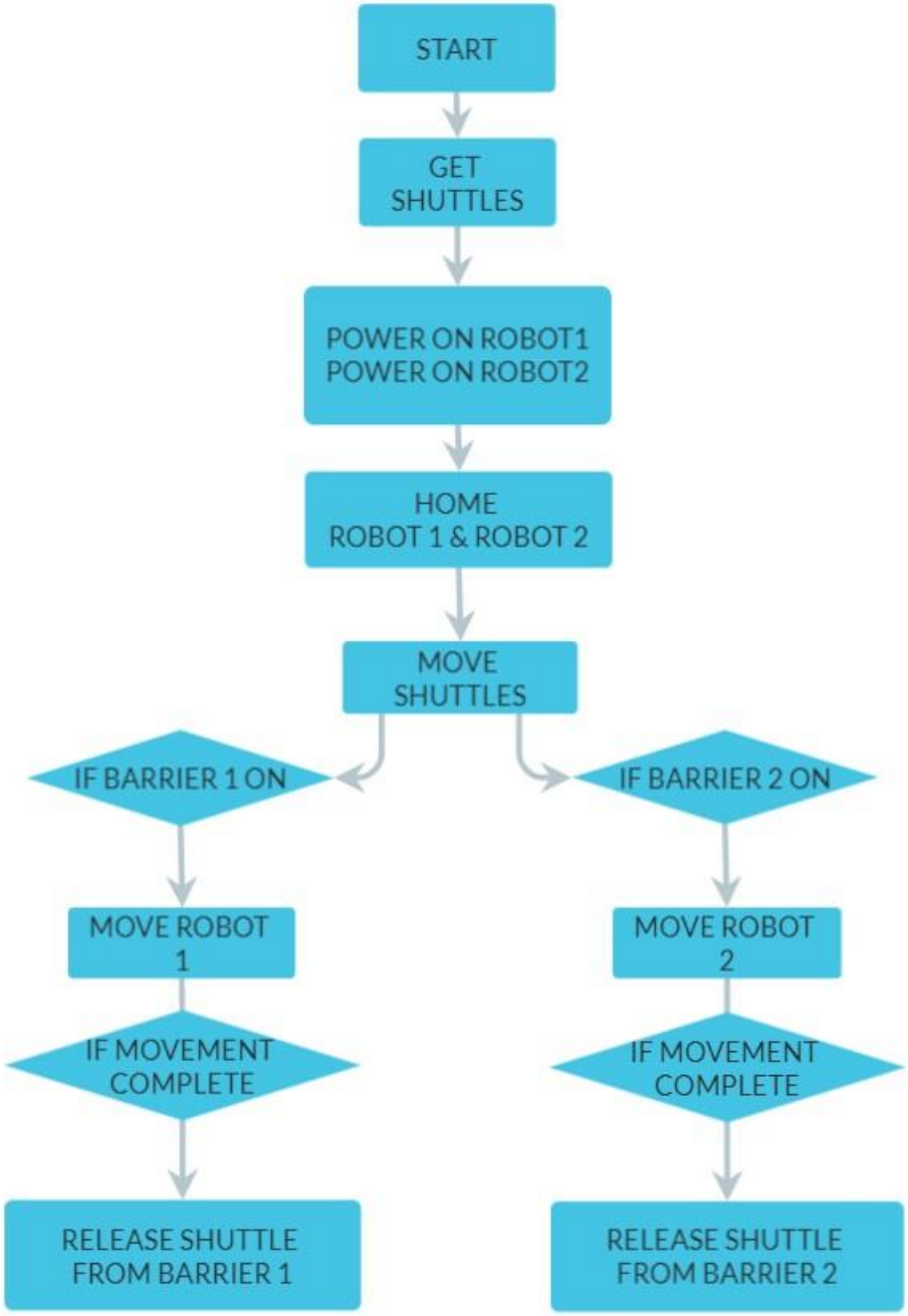
Data provides to add additional data to the logged process variables, such as a description, scaling or unit. History of data is also provided. Data provides access to statistical information regarding logged data so that we can improve the quality and efficiency of machine.

f. Mapp File :-

Mapp File helps us create file explorer for our HMI. Displaying a file browser is the main function of File. We are able to browse through my file structure and do things like create/delete folders, copy files from one storage medium to another, etc.

4.5 Automatic Control:-

Our program has the facility to move all the machine with single click. When Start button is pressed, machine will start to run properly without any need to operate give other commands. After pressing start button, fist Acopostrak and 2 Delta robots are powered on. Then the robots are moved to the home position. Then shuttles will start their movement. As shuttles stops at barrier the robot will then move.



4.6 Emergency Stop:-

Emergency stop is most important function in any system. In case of any malfunctioning observed by the operator, there is emergency stop button. By pressing this button, all the operations will be terminated at that place.

In our project also we have implemented emergency stop button. By pressing that button all the operations will be stop at that point only. This is used to avoid any future damage which could be caused if the system continues to run. We have provided emergency stop buttons on all the pages of the HMI.

CHAPTER 5

5.1 Conclusion: -

Humans are being displaced by machines as industries evolve. Because the demand for the items would rise, industries will have to raise their output. And to do so, businesses must embrace automated technologies in order to meet the needs accurately and in a shorter length of time. Our idea is the greatest potential consequence for the aforementioned problem; in the future, companies will become more reliant on automation technology to achieve precision and maximum production in the shortest feasible period.

Our "End of Line Packaging Solution" project is a solution to challenges like as packaging defects, time delays, and sluggish processes. This solution may be used in any packaging business, as well as the gadget industry, and will be widely used in the food and beverage industry.

The design, development, and deployment of Delta 3 axis Robot, Acopostrak, and Mapp technology for packaging operations are covered in this study. This project was created using B&R Automation Studio, and it met the goal set for it.

5.2 Future Scope: -

Collaborative robots are the hottest trend in the automation industry. Next generation machines equipped with state-of-the-art sensor technology allow robots to operate side by side with humans. Unlike traditional robots, collaborative machines are lightweight, flexible and can easily be moved and reprogrammed to solve new tasks. They require little or no safety barriers, which consume valuable bench and floor space, obstruct access to equipment and reduce productivity. Collaborative robots are the hottest trend in the automation industry

Magnetic levitating shuttles move individual products freely through the machine. ACOPOS 6D is ideal for small-batch production with frequent changeover between products of different designs and dimensions. Unlike traditional robots, collaborative machines are lightweight, flexible and can easily be moved and reprogrammed to solve new tasks. They require little or no safety barriers, which consume valuable bench and floor space, obstruct access to equipment and reduce productivity.

5.3 Applications: -

This notion may be used in a variety of ways-

- In the food and beverage industry, this notion is commonly employed.
- It may be used to arrange items into categories based on their specifications.
- It may also be used to pack Smart-Phones and other electronic devices.
- If we change the code, we will be able to discover faulty items throughout the packaging process.
- It may be used to make small gadgets and processors.
- It is employed in situations when quick and exact results are required.

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