A PROJECT REPORT

ON

"DESIGN 3 IN 1 MODULE OF A DRAWOUT MCC PANEL"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of BACHELOR'S DEGREE IN

MECHANICAL ENGINEERING

BY

SHAIKH GANIM RIZWAN	17ME90
SHAIKH MOHD SHOAIB ISRAIL	17ME93
SHAIKH MERAJ MEHTAB	17ME91
SHAIKH ATIQUR RAHMAN KARIM	15ME43

UNDER THE GUIDANCE OF

PROF. SAAD SHAIKH

DEPARTMENT OF MECHANICAL ENGINEERING

Anjuman-I-Islam's Kalsekar Technical Campus

SCHOOL OF ENGINEERING & TECHNOLOGY

Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

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CERTIFICATE

This is certify that the project entitled

"DESIGN 3 IN 1 MODULE OF A DRAWOUT MCC PANEL"

submitted by

SHAIKH GANIM RIZWAN	**17ME90**
SHAIKH MOHD SHOAIB ISRAIL	**17ME93**
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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Mechanical Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2018-2019, under our guidance.

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I would like to take the opportunity to express my sincere thanks to my guide **Prof. SAAD SHAIKH**, Assistant Professor, Department of Mechanical Engineer- ing, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout my project research work. Without his kind guidance & support this was not possible.

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At last we must express our sincere heartfelt gratitude to all the staff members of Mechanical Engineering Department who helped me directly or indirectly during this course of work.

SHAIKH GANIM RIZWAN
SHAIKH MOHD SHOAIB ISRAIL
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Project I Approval for Bachelor of Engineering

This project entitled “Design 3 in 1 Module of a Drawout MCC Panel”

BY **SHAIKH GANIM RIZWAN, SHAIKH MOHD SHOAIB ISRAIL, SHAIKH MERAJ MEHTAB and SHAIKH ATIQUR RAHMAN KARIM** **is approved for the degree of Bachelor of Engineering in Department of Mechanical Engineering.**

Examiners

1. .....
2. .....

Supervisors

1. .....
2. .....

Chairman

.....

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or fal- sified any idea/data/fact/source in my submission. I 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.

Student Name
Roll Number:

ABSTRACT

Low-voltage motor control center (MCC) are numerous and consume portion of maintenance and operator interaction in an industrial power system. The extensive human interaction withs these low-voltage circuits makes a low-voltage MCC significant potential hazard. Due to which The large number of low-voltage MCC panel significantly more human interface time with the low-voltage MCC equipment than with medium-voltage MCCs and switchgear. This is modern protection and control systems derived power systems have much to offer solution of low-voltage MCC systems. Proactive maintenance indicator based on load characteristics and motor start characteristics, and thermal measurements are described. Sequence of events are to Time synchronization modern Ethernet-based protocols, sequence of events records oscillargy monitoring and alarming for protection functions, and other previously features medium- and high-voltage protective relays are available in modern low-voltage MCC protective relays. Increased safety in the form of advanced protection elements and arc-flash detection are now also available. This paper focuses on the philosophy of a comprehensive low-voltage MCC protection and control system.

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CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

A motor control center (MCC) is an assembly to control some or all electric motors in a central location. It consists of multiple enclosed sections having a common power bus and with each section containing a combination starter, which in turn consists of motor starters, fuses or circuit breaker, and power disconnect. A motor control center can also include push buttons, indicator lights, variable-frequency drives, programmable logic controllers, and metering equipment. It may be combined with the electrical service entrance for the building.

MCC's are typically found in large commercial or industrial buildings where there are many electric motors that need to be controlled from a central location, such as a mechanical room or electrical room.

VOLTAGE RANGES

Motor control centers are usually used for low voltage three-phase alternating current motors from 208 V to 600 V. Medium-voltage motor control centers are made for large motors running at 2300 V to around 15000 V, using vacuum contactors for switching and with separate compartments for power switching and control.

USAGE

Motor control centers have been used since 1950 by the automobile manufacturing industry which used large numbers of electric motors. Today they are used in many industrial and commercial applications. Where very dusty or corrosive processes are used, the motor control center may be installed in a separate air-conditioned room, but often an MCC will be on the factory floor adjacent to the machinery controlled.

COMPONENTS

A motor control center consists of one or more vertical metal cabinet sections with power bus and provision for plug-in mounting of individual motor controllers. Very large controllers may be bolted in place but smaller controllers can be unplugged from the cabinet for testing or maintenance. Each motor controller contains a contactor or a solid-state motor controller, overload relays to protect the motor, fuses or a circuit breaker to provide short-circuit protection, and a disconnecting switch to isolate the motor circuit. Three-phase power enters each controller through separable connectors. The motor is wired to terminals in the controller. Motor control centers provide wire ways for field control and power cables.

SPECIFICATIONS

Each motor controller in an MCC can be specified with a range of options such as separate control transformers, pilot lamps, control switches, extra control terminal blocks, various types of thermal or solid-state overload protection relays, or various classes of power fuses or types of circuit breakers. A motor control center can either be supplied ready for the customer to connect all field wiring, or can be an engineered assembly with internal control and interlocking wiring to a central control terminal panel board or programmable controller

FIRE PROTECTION

Motor control centers usually sit on floors, which are often required to have a fire-resistance rating. Firestops may be required for cables that penetrate fire-rated floors and walls.

PURPOSE

1. The project involves designing and manufacturing a drawout units of MCC panel.
2. The projects are divided into 3 steps Analysis, Designing and Manufacturing.
3. The Advantages of this is that we can control 3 motors with a single drawout at a same time.
4. In each Drawout there will be 3 starter units.

PROJECT SCOPE

1. To minimize the time and to get the maximum output work with the help of 3 in 1 draw out panel.
2. To increase the efficiency of the panel.

CHAPTER 2
LITERATURE SERVEY

CHAPTER 2
LITERATURE SERVEY

Low voltage (LV) panels are most common across all the industries and one of the more common special requirement which need to be designed in accordance with safety standards prevailing. An electrical panel is that the combination of protection and switch devices assembled in one or a lot of adjacent compartments. To design a low tension or low voltage panel , the procedure for the designing a panel is designing the system.

From this paper we have learned about and worked on the MCC panels and induction motors. Done practically and circuited own, controlling the equipment was examined practically.

Eaton's motor control centers (MCCs) provide a convenient method for grouping motor control, as well as associated distribution equipment. MCCs may be applied on electrical systems up to 600 V, 50 or 60 Hz, having available fault currents of up to 100,000 A rms. ensures a quality product that meets the latest safety codes. Freedom DC motor control centers are available up to 250 Vdc, having available fault currents up to 22,000 A rms.

From this paper we have learned about the voltage and how much current accuringing in motor.

The concept of lean manufacturing was developed for maximizing the resource utilization through minimization of waste. The main purpose is to eliminate the non-value added activities present in the assembly section and also to reduce the material waste. Value stream map is the technique that bring the all processing steps at one place. It shows the big picture of shop floor rather than individual processes and improving the each area at the production line.

Based on the studies, the main operation and strategy of the company and the total production time for all operation total time calculated. From the data obtained, it is analyzed that there is a large difference in work contain and the time taken by each operator.

A panel is made by adding compartments as per the specified form of construction, that is termed "enclosure" (with support and mechanical protection functions for the various parts enclosed), and therefore the electrical instrumentality, represent by the equipment, the interior affiliations and therefore the incoming and outgoing feeders for the connection to the installation. This paper is mainly on the lv switch gears.

To design a low tension or low voltage panel, the procedure for the designing a panel is designing the system as per customer requirement the enclosure shall be designed by using proprietary software.

In this type each feeder is housed in a separate compartment (module) of its own and attending on one would limit the exposure only to that unit. In this construction a fault, particularly of the nature of a short-circuit, will be contained and localized only to the faulty feeder, without spreading to the nearby feeders. This is an economical and most used construction of switchgear assemblies for light and power distribution and motor controls. When feeders of an assembly are mostly for motor controls, these assemblies are referred to as motor control contres (MCCs).

When feeders of an assembly are mostly for motor controls, these assemblies are referred to as motor control contres (MCCs) only feeders are housed in one enclosure, and attending on one would mean an exposure to the others.

Motor control centers (MCC) have come a long way since they were intro duced in 1937 as a way to save floor space by placing several starters in a single cabinet. Modern processes and facilities now dictate that motor control centers should display a high level of intelligence as well. They must deliver vital operating information; plus provide automation features, optimal control, and critically fast communications to meet even the most demanding applications. Ideally, the best-of the-best must also save installation time and money.

They come with rear-mounted, self-aligning copper stabs that firmly grasp onto the bus. Brackets also guide the place ment of units, further assuring positive engagement with the bus.

motor control centers shall be the same as Class I motor control centers with the addition of manufacturer furnished electrical interlocking and wiring between units as specified in overall control system diagrams supplied by the purchaser. In addition to the drawings furnished for Class I motor control centers, the manufacturer shall furnish drawings that indicate factory interconnections within the motor control center.

Manufacturer's standard diagrams for individual units and master terminal boards (Type C wiring only) consist of one or more drawing(s) that:

1. Identify electrical devices.
2. Indicate electrical connections.
3. Indicate terminal numbering designations.

motor control centers shall consist of mechanical groupings of combination motor control units, feeder tap units, other units, and electrical devices arranged in a convenient assembly. The manufacturer shall furnish drawings that include Overall dimensions of the motor control center, identification of units and their location in the motor control center, locations of incoming line terminals, mounting dimensions, available conduit entrance areas, and the location of the master terminal board if required (Type C wiring only).

It is used to draw attention to different wastes and eliminating them in future state map by different lean techniques. The study of current state map shows the areas for improvement and identifying the different types of wastes. The present and future state of value stream map are constructed to improve the production process by minimizing the non-value added activities which are identified from the VSM. Before Current State Value Stream Mapping (CSVSM) tool used in panel manufacturing industry by focusing both on processes and their cycle times for a product Power Control Center (PCC) & Motor Control Centre (MCC) in present scenario.

To achieve this goal, lean principle was most significant lean techniques called Value Stream Mapping to improve the assembly line of electric panel production industry. So, there is a need for reduced the Non Value Added Activity.

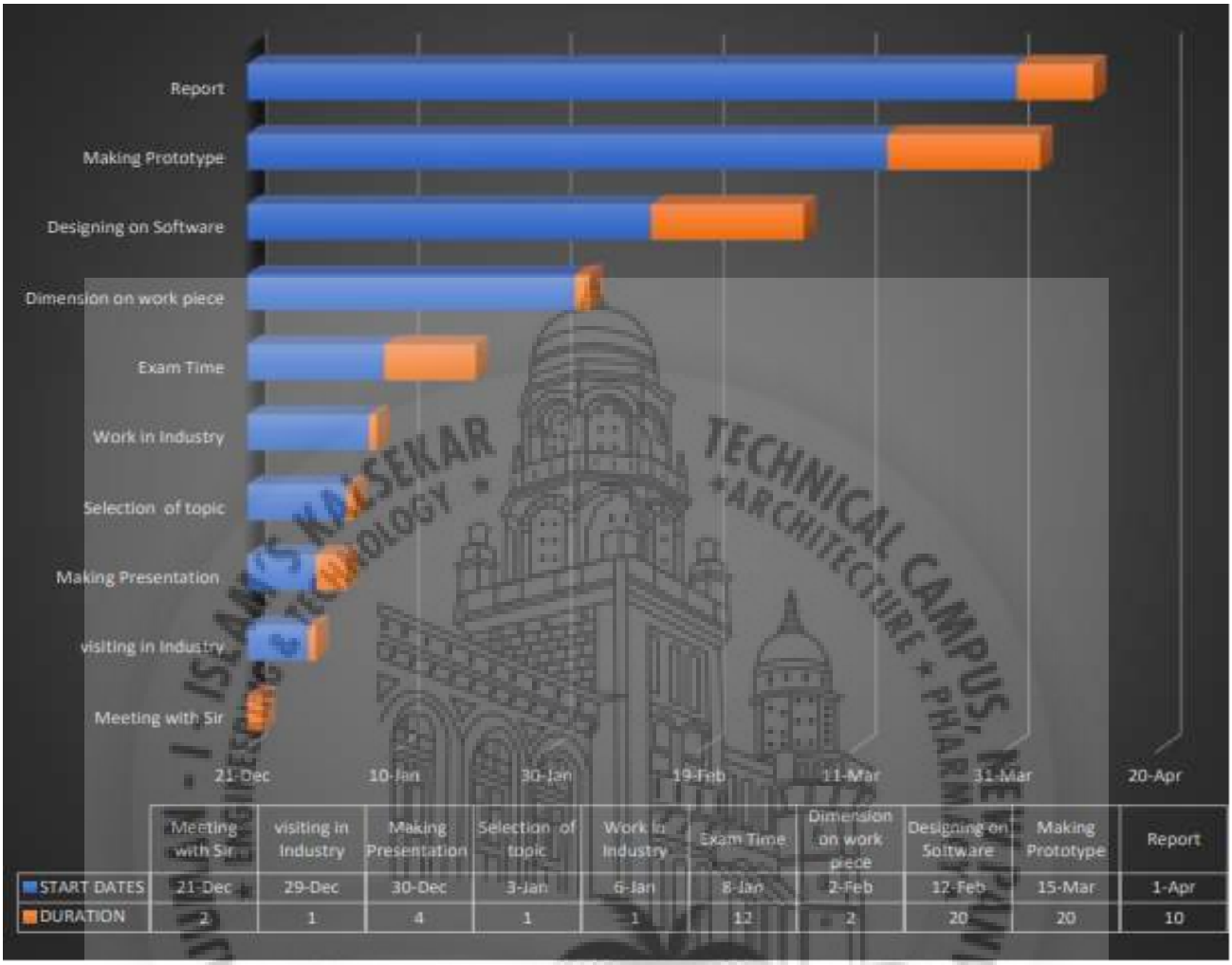
In electric panel manufacturing all the raw material collected form store and various vendor. Form the store material issue by Bills of Material (BOM). In First of all there are create an Electrical Design and Mechanical Design (3D). After mechanical drawing approved then drawing go to panel fabrication phase. When panel was fabricated then come to assembly line. At assembly line there are assembly of Busbar, Switchgears and wiring was done as per General Arrangement (GA) drawing.

PCC-2014 Power Control Centre are used as main IOW voltage switchboards in power stations, large industrial plants,, process industries and other heavy plants for distribution and control of power. PCCs can be supplied With Air Circuit Breakers, MCCBS, Fuse Switch Units, Isolators etc. With busbars rated upto 4000A. PCCs with higher busbars ratings are also supplied for special applications. MCC-2014 draw-out motor control centers are used for distribution, control, metering and protection of electrical power. MCCs are normally used in thermal, hydro, nuclear and combined cycle power generating stations in paper, cement, petrochemical steel and fertilizer plants and also in every other process industry. MCCs also find their application in ships due to higher eve' Of protection & reliability required in the system.

This study helps to identify the waste and eliminate it sept by step, thereby reducing the Non Value Added Activity. So, also reduce total production time of electric panel by Lean principle.

CHAPTER 3
PROJECT TIMELINE

3.1 Project Timeline :-



	Meeting with Sir	visiting in Industry	Making Presentation	Selection of topic	Work in Industry	Exam Time	Dimension on work piece	Designing on Software	Making Prototype	Report
START DATES	21-Dec	29-Dec	30-Dec	3-Jan	6-Jan	8-Jan	2-Feb	12-Feb	15-Mar	1-Apr
DURATION	2	1	4	1	1	12	2	20	20	10

Figure 3.1 Gantt Chart

- we started our project with zeroth level presentation in which we have discussed and confirmed the project topic with our project **guide prof. Saad sir .**
- we have visited many industry for the project topic and finally we got the required topic in **Sunseons** industry which is located in **Rabale**.
- The project was about the **drawout module** which is present in **MCC panel** . In the past there is only 1 in 1 drawout module is present . But our aim is to make 3 in 1 drawout module so in this process we have contacted **our guide prof. Saad sir and prof. Riyaz sir** .

- Our main objective waas to control more number of motors in the lesser time and give accurate result.
- Firstly, we take dimension of each and every part of drawout module and when it is done after which we make a rough design on the paper to get the idea.
- And then after it is done we make a design of the project which is created in **3D Modelling software** .
- Our target was to complete the design in the given span of time.
- Finally, the assembly of all the part was done on the software and it is completed. Our actual schedule time is bit lagging because of current situation and also because of some family problems.

CHAPTER 4
DESIGN

CHAPTER 4

DESIGN

4.1 MODELING

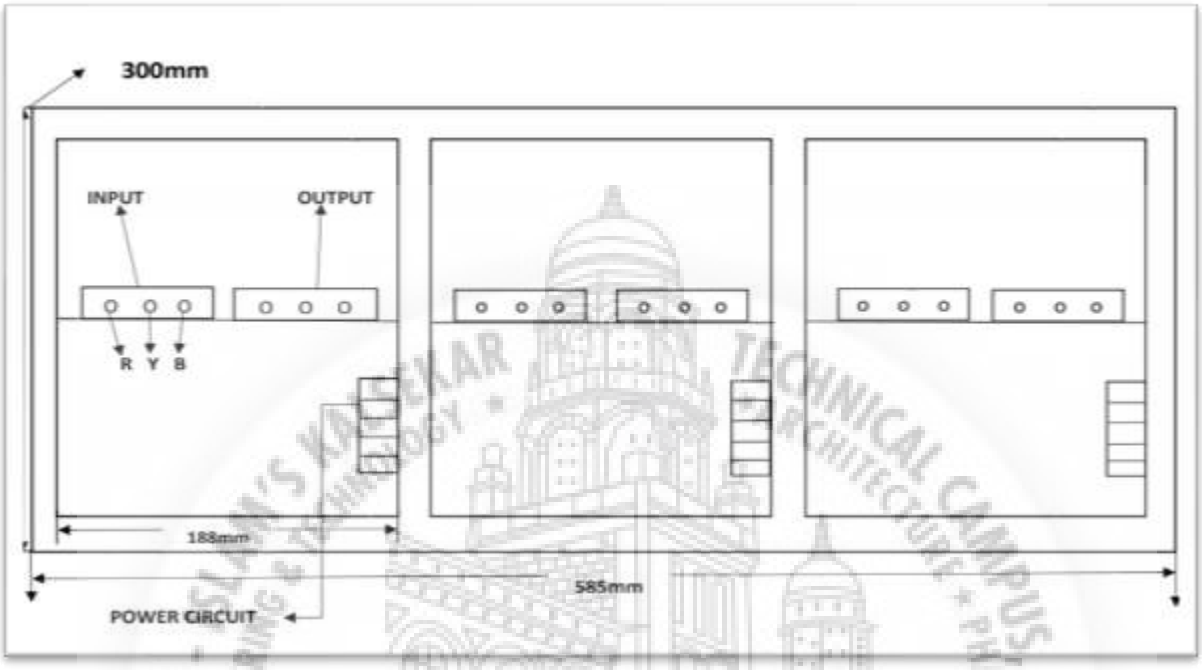


Figure 4.1

In figure 4.1 , the basic structural Layout of the project. It consist of many parts like module, incoming/outgoing source, power contacts, Auxillary contacts, trolley, etc. Each parts of the projects give us the dimension and working of the system. The main aim behind this is to get the desired results and less use of time. In drawout module, There present a feeder. A feeder is a part a motor. In one drawout module there is 3 feeder which control 3 different motor. All 3 feeder are of same size and they can be easily Interchangeable. We have to design it so perfect that it can be easily Gluideable in unidirection fully drawout module has 3 distinet functional position i.e service, Test and isolated. We also give same equal distance between corresponding feeder.

4.2 Layout of MCC Panel

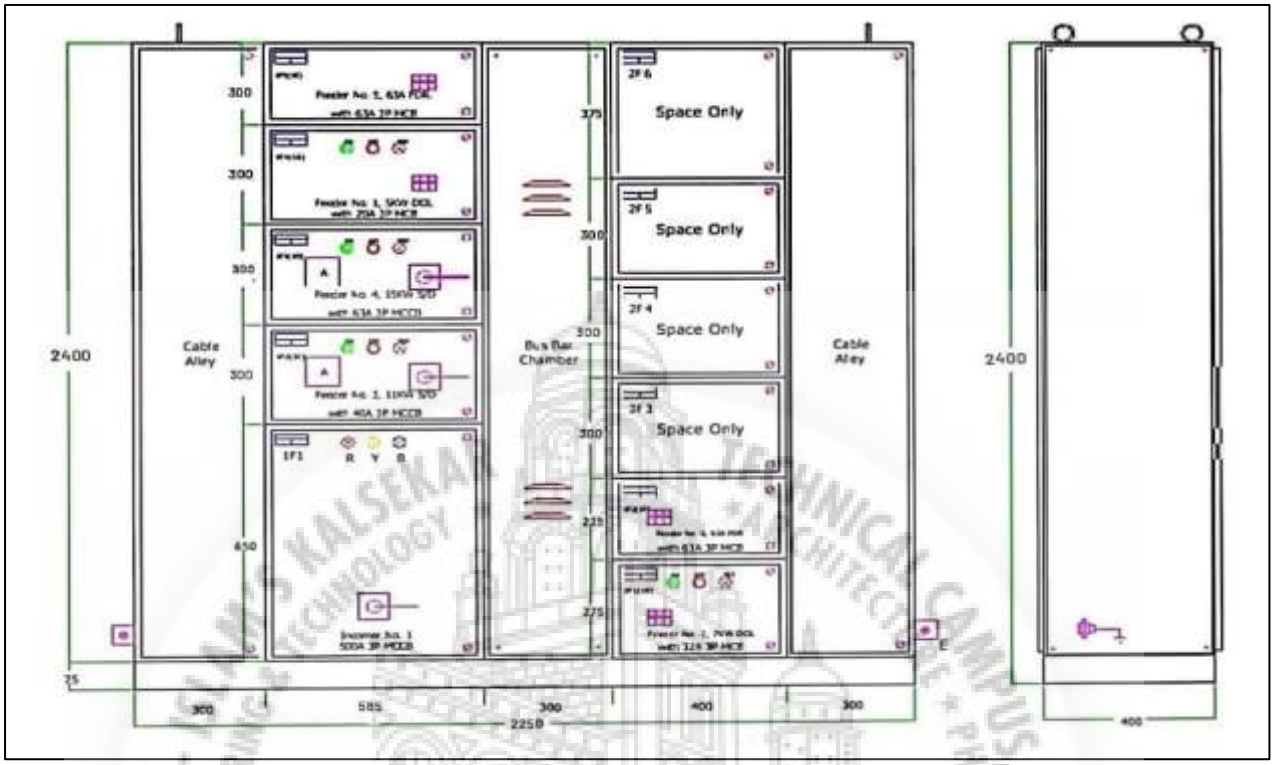


Figure 4.2

In Figure 4.2 is a Layout of MCC Panel . In MCC panel there are various types of components chamber and cables. In this fig there present a drawout module in vertical section. In same industry there's 4 drawout module in vertical section and in same there present 6 drawout module. All drawout module gets input from Basbar Chamber and from drawout module. Every drawout module is same in dimensions and they can easily be interchangeable. The MCC Panel gets power from PCC Panel through BusBar.

4.3 3D MODEL

The 3D Model we are Design by using Autodesk Inventor software . Motor Controller Center panels are made up of 14/16 SWG CRCA material semi bolted structure firmly supported. Ensures desired breaking capacities, temperature rise & IP protection. Enough Space for incoming & outgoing Cable termination. Outgoing terminals are stud type as standard practice.The supporting structures which form the framework are made up from 2.0 mm thickness steel sections. The entire wiring is done with high grade bright copper annealed standard PVC or FRLS or HR FR insulated flexible wires.

The Various part of 3D model are following:

1. Incoming source
2. Mounting Plate
3. Power Contacts
4. Auxillary Contacts
5. Trolly
6. Slider

4.3.1 Incoming Source :-

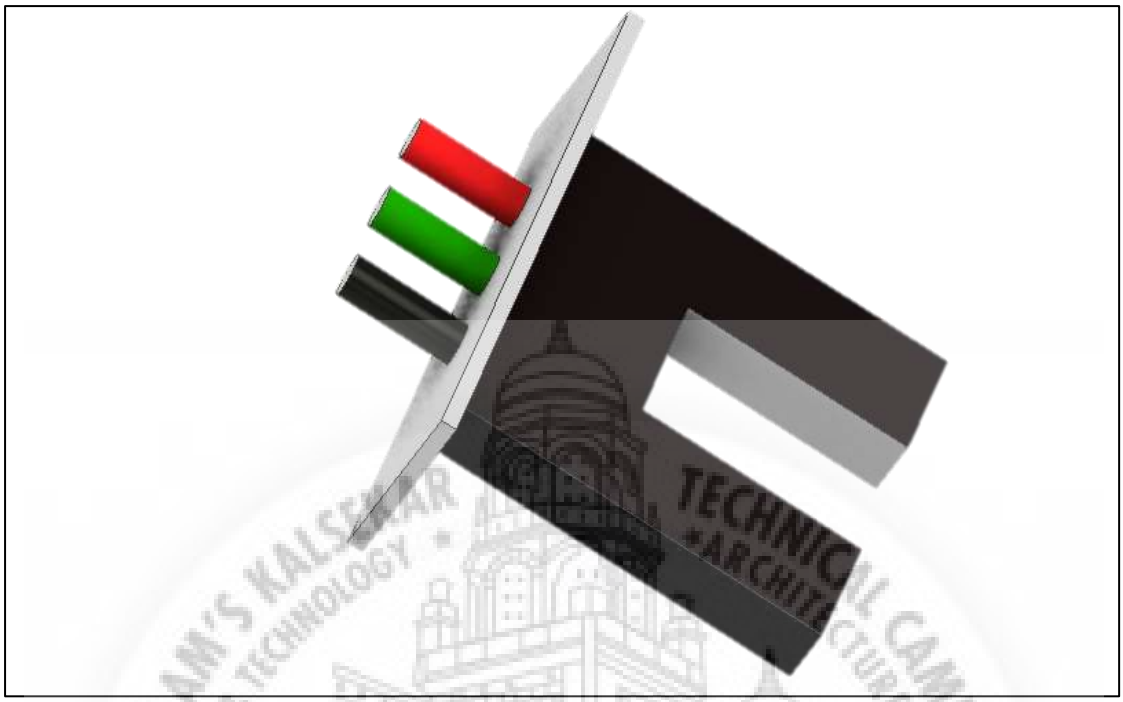


Figure 4.3.1

In figure 4.3.1,The part of the design which is one of the important part. There are various type of material are used but mainly the zinc plated steel is used .

- It is connected to buss bar which gives power to feeder from MCC panel.
- The current varies for other system mainly upto 800 Amps.
- The current passes from Incoming sources and goes through feeder and comes out from Outgoing sources.

- **Specification:-**

Length	**60mm**
Breadth	**30mm**
Width	**5mm**

4.3.2 Mounting Plate :-

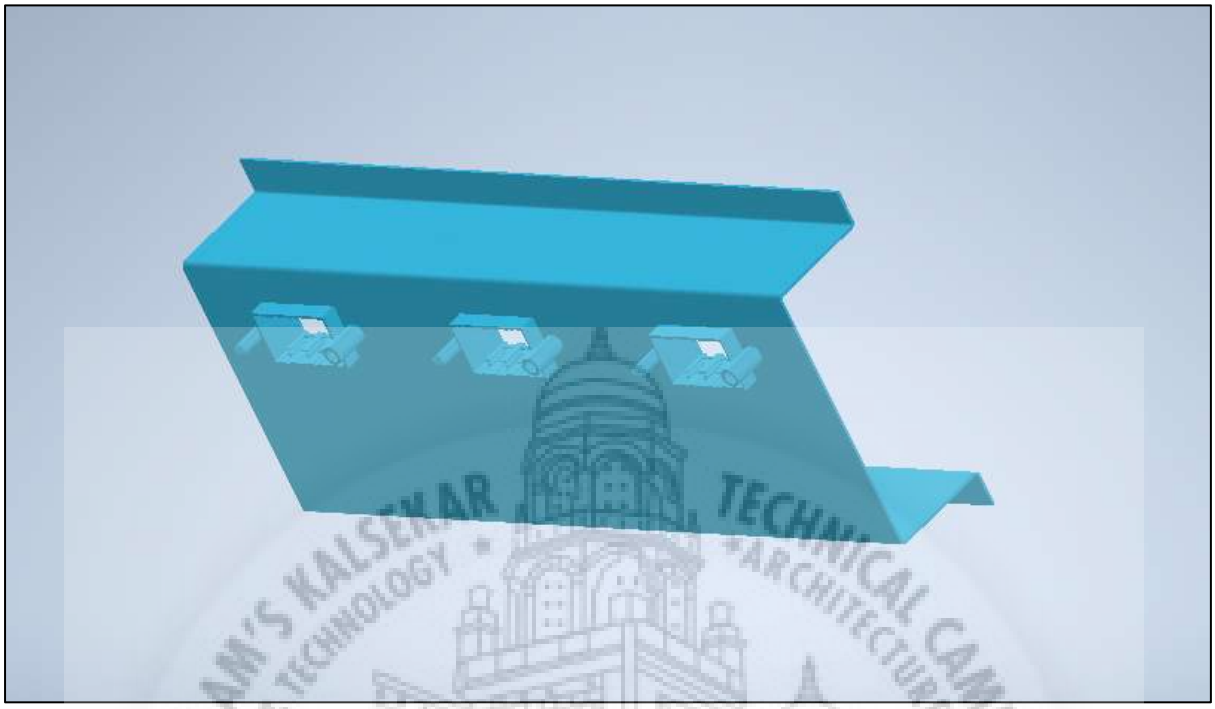


Figure 4.3.2

- This is the mounting plate in which incoming sources passes through .
- The trolley which is main part is also mounted on this.
- - In this plate the Harting (i.e Power Contact) is mounted on.
- - The material used are various type of steel but mainly Aluminium Alloys.

- **Specification :-**

Length	**507mm**
Height	**231mm**
Thickness	**02mm**
Distance between Rectangular cuts	**168.67**

4.3.3 Power Contacts :-

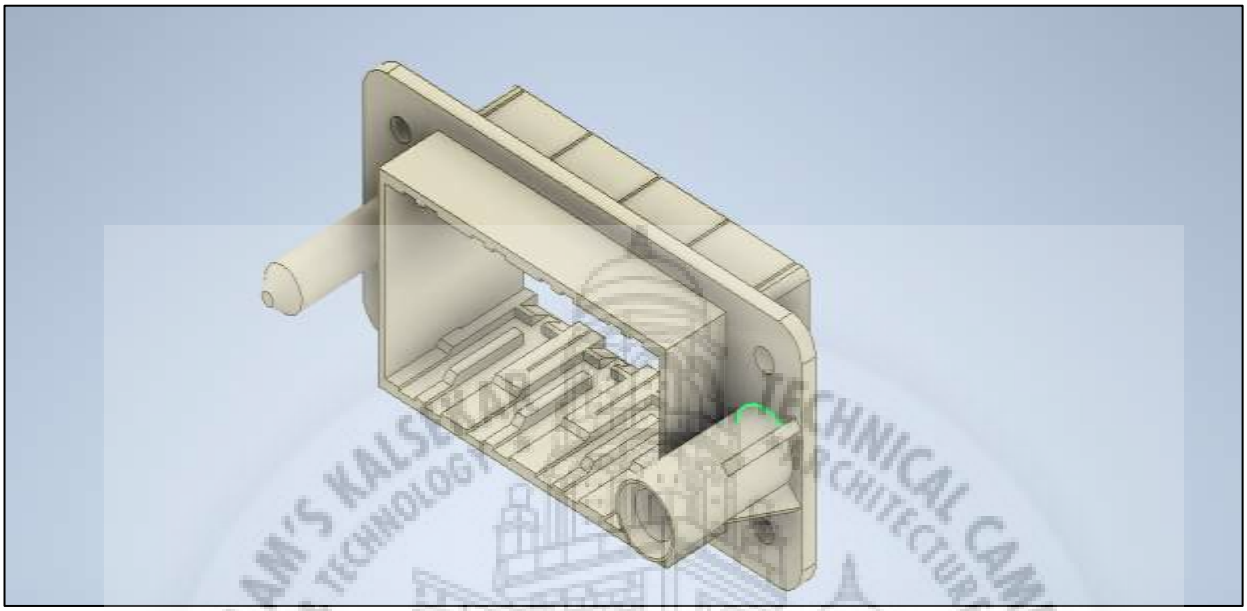


Figure 4.3.3 a) Male part

A Contact is a large relay, usually used to switch current to an electric motor or an other High-power load .

- The Hartening has two parts i.e male part and female parts .
- In this design , we used Hartening as on power contacts .
- It is used to protect the motors from the over excessive currents .
- The Hartening is mounted on mounting plate .
- Blind mating connector system for drawer systems
- Highest flexibility due to a product range of over 100 connector modules.
- Direct panel mounting without hoods and housings
- Leading centring system compensates for tolerances of +/- 2 mm

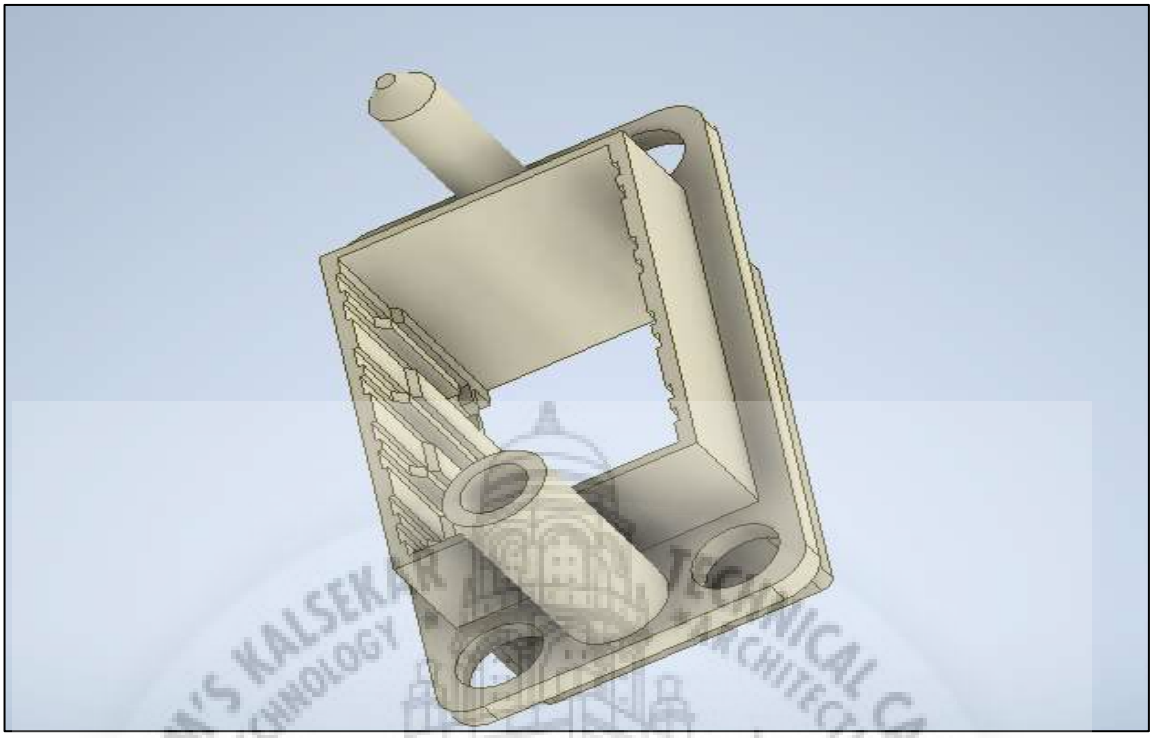


Figure 4.3.3 b) Female part

- **Specification :-**

Material	**polycarbonate (PC)**
Limiting temperature	**-40 ... +125 °C**
Mating cycles	**≥ 500**
Mating cycles with other HMC components	**≥ 10,000**
Floating tolerance	**± 2 mm**
Lock-in range	**± 4 mm**

4.3.4 Auxillary Contacts :-

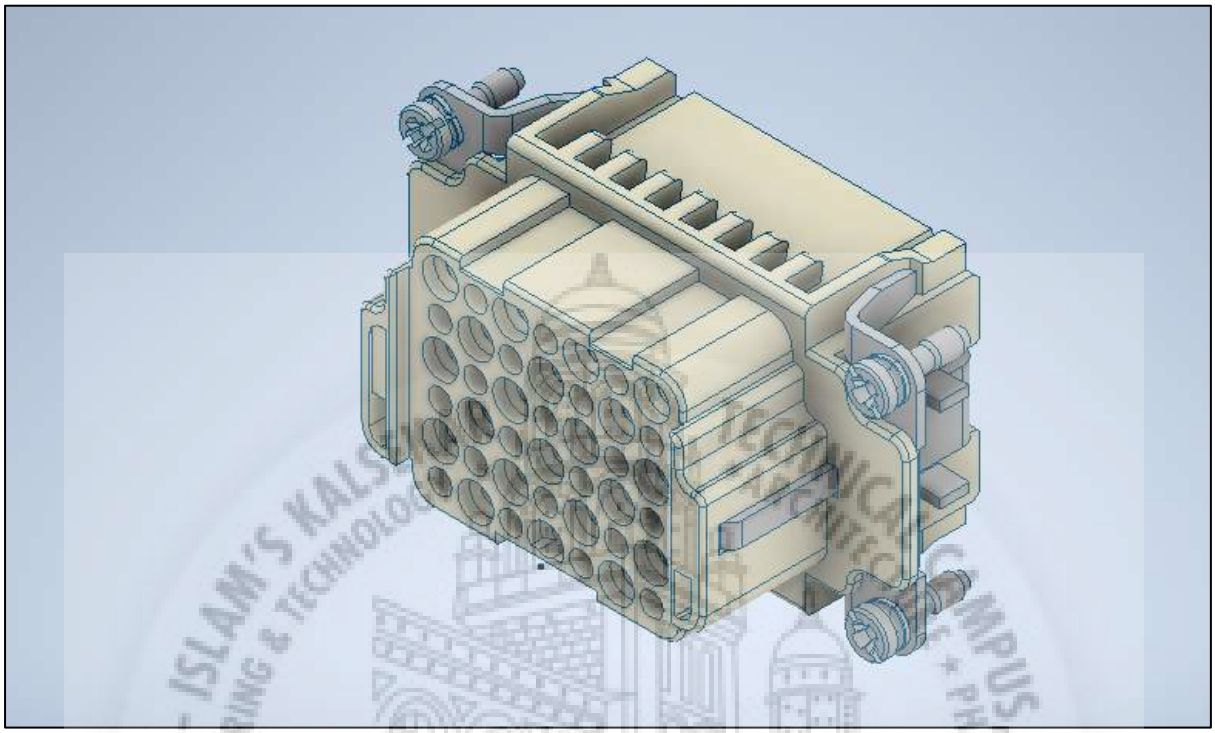


Figure 4.3.4 a) Female part of Auxillary contacts

- In Figure 4.3.4 An Auxiliary contacts is a regular (low-power) relay - but built like a "regular" contactor and when used together with another contactor it is called auxiliary contacts to clarify that it is not used for switching loads but has an activation/deactivation or control function instead - used to connect/disconnect a circuit (in a nutshell: to control load contactors).
- Auxillary switch is a switch which is mechanically attached to the main contact (i.e Power Contact) and operates when the breaker changes its position (from ON to OFF or from OFF to ON).
- Now , when the auxillary switch operates its contacts is called as Auxillary Contacts
- It is also connected between two parts thats mounted plate and trolley.

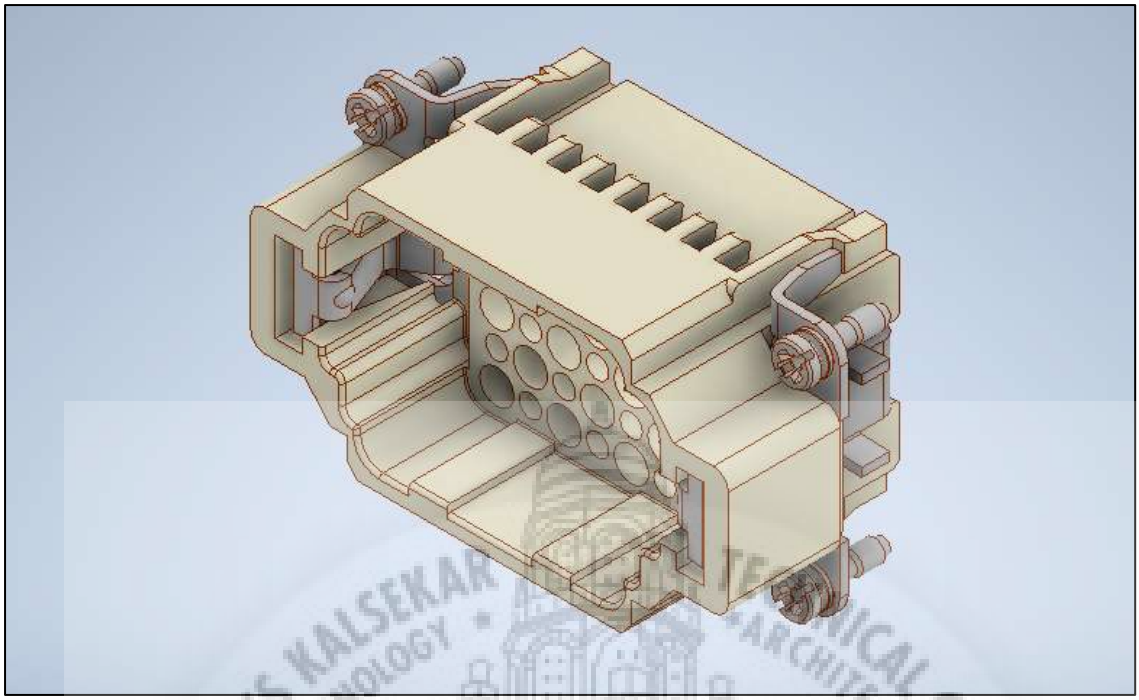


Figure 4.3.4 b) Male part of Auxillary contacts

- **Specification** :-

Conductor cross-section	**0.14 ... 2.5 mm²**
Rated current	**10 A**
Rated voltage	**250 V**
Rated impulse voltage	**4 kV**
Pollution degree	**3**
Rated voltage acc. to	**UL600 V**
Rated voltage acc. to	**CSA600 V**
Insulation resistance	**>1010 Ω**
Limiting temperature	**-40 ... +125 °C**
Mating cycles	**≥ 500**

4.3.5 Trolley :-

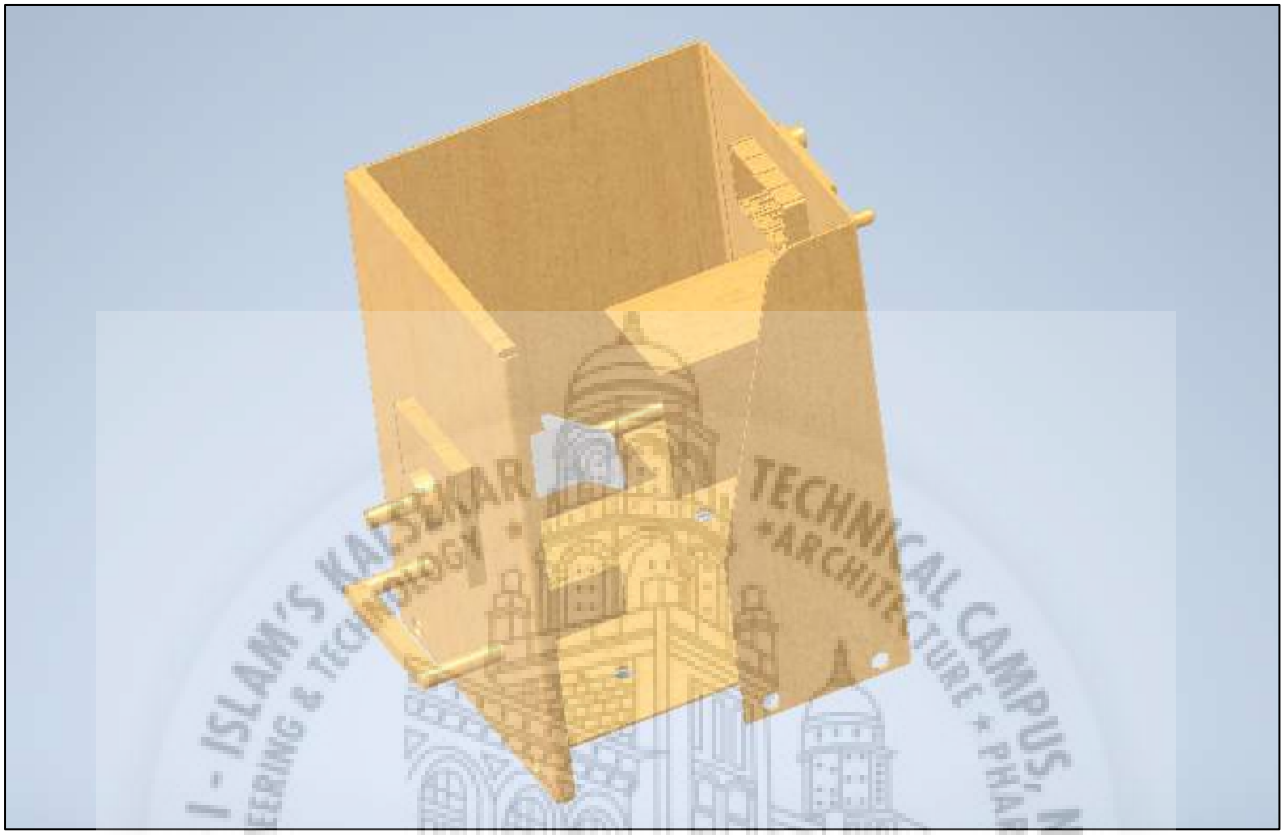


Figure 4.3.5

- It is the main components of the design.
- Drawout trolley/module are also manual disengagement in three distinct position i.e Service , Test & Isolation.
- Drawout units are fully Interchangeable
- Drawout units can be easily replaceable without harming other units.
- In this part all the current enters and leaves from the outgoing sources .
- Standard module size minimum 225mm.
- In Trolly there are some part also attach (**i.e Figure 4.3.5 a) Locking System , Stopper)**

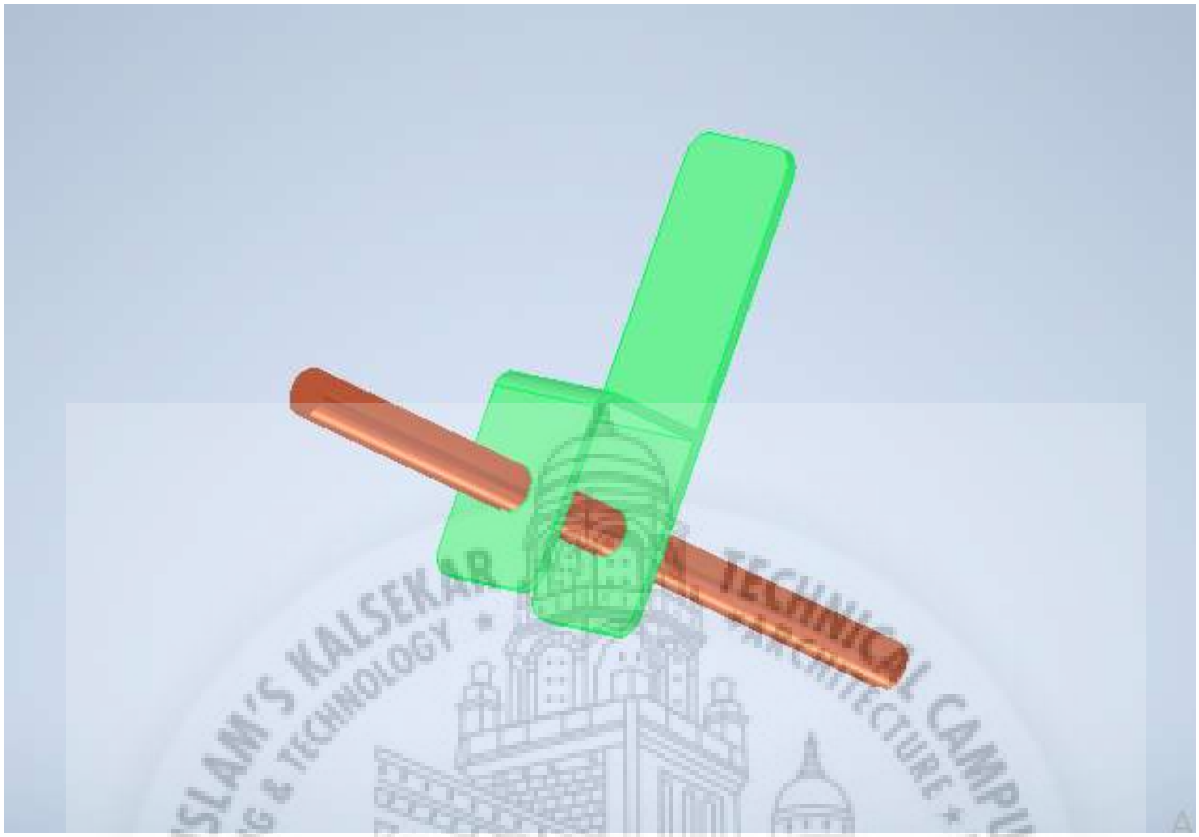


Figure 4.3.5 a) Locking System.

- Above figure 4.3.5 a shows that the **locking system** of the module. When it is open it is perpendicular to the axis of the shaft and when it is closed it is parallel to the axis of the shaft. When it is closing it rotates in the clockwise direction and gets locked. There's a stopper in 90 degree rotation of the shaft where it stop. Locking system is located in the inside of the module. It is present to open and closed the feeder. It is also present to remove the module Or interchange the module.

4.3.6 Slider :-

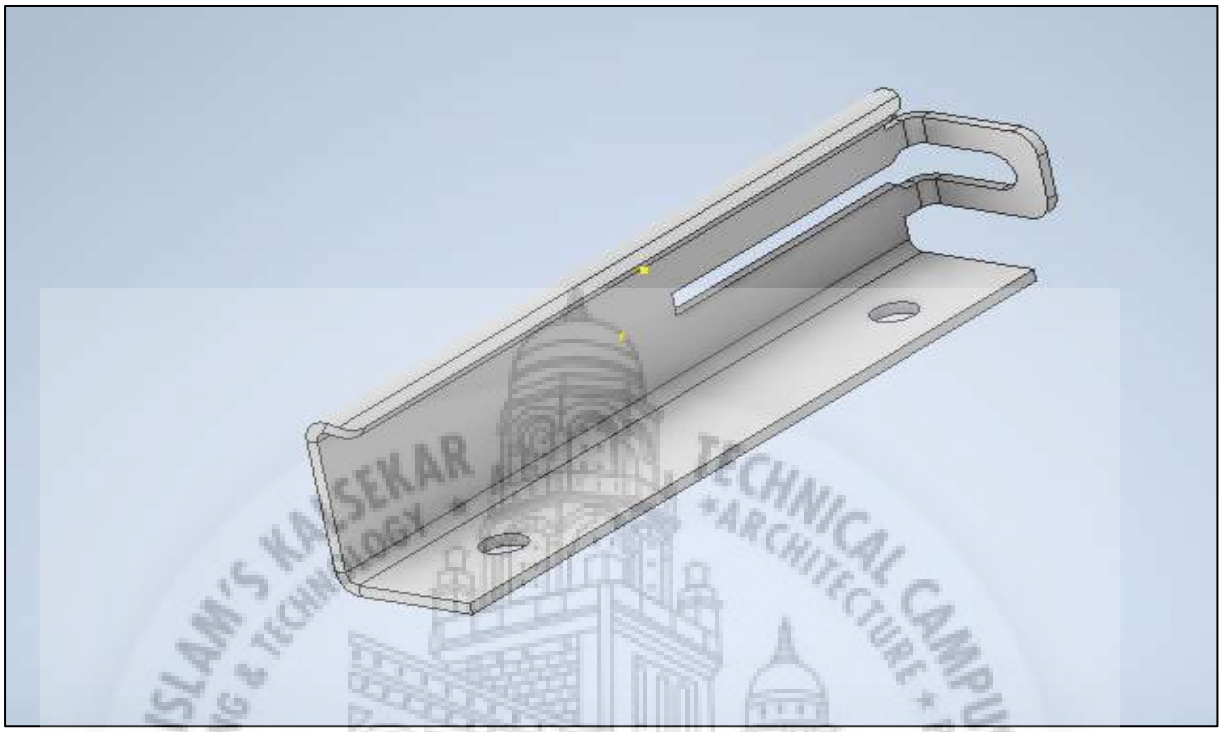


Figure 4.3.6 a) Slider connected with Trolly

- Figure 4.3.6 show tha sliding part of the project. A devices which enable individual drawers to slide in and out of the drawer unit allowing users to easily access the objects contained within.
- A sliding is a part of design which opens horizontally. It is one of the important part of the project. It guides the drawout module to the Exact place. It is mounted on the bottom of the drawout module. It slides the drawout module to and fro.
- Slider are typically composed of two mated, epoxy-coated metal profiles—one which attaches to the drawer and one which attaches to the cabinet frame—and nylon wheels—which allow the profiles to move smoothly and quietly along each other.

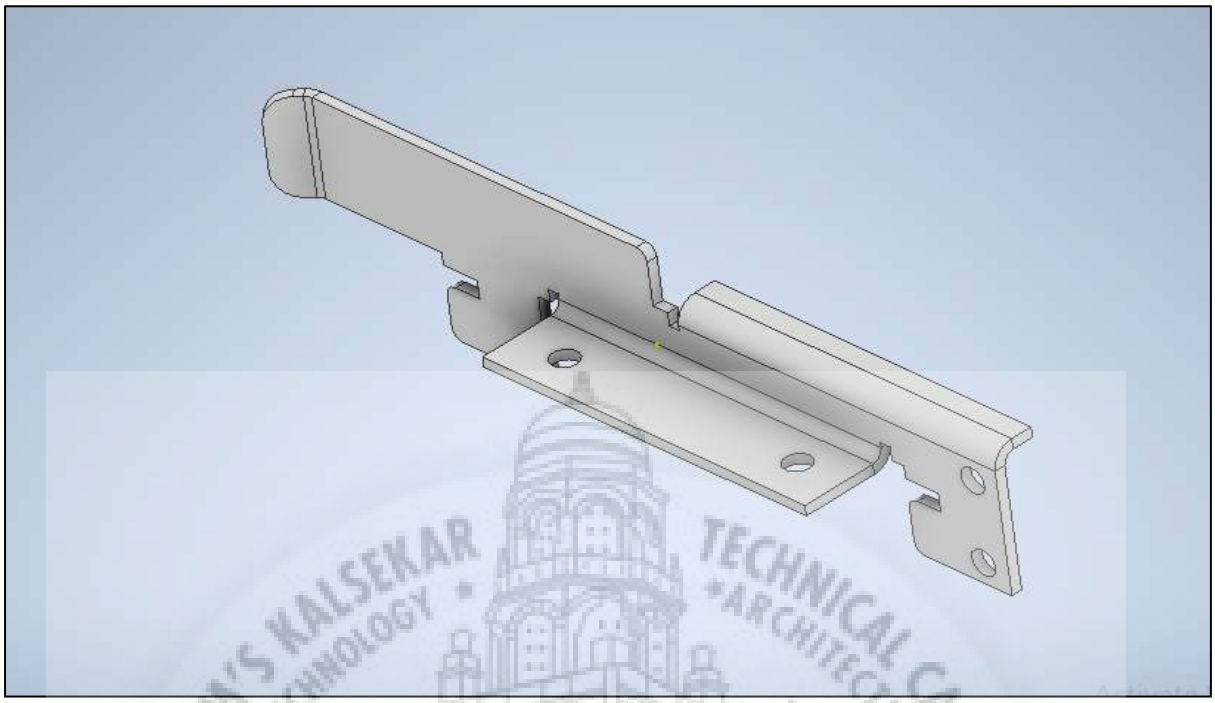


Figure 4.3.6 b) Slider Connect with base plane

- In addition to the mechanisms outlined above, which allow slider to be opened and closed by a user, there are optional functions and features available for slider, which can increase functionality and improve user experience.
- Push-To-Open: slider open when pressure is applied to the front face, eliminating the need for additional hardware components
- Hold-In/Hold-Out: slider remains opened or closed until a specific level of force is applied
- Lock-In/Lock-Out: slider remains locked opened or closed until a lever component is released.

4.3.7 Final Assembly :-

Figure 4.3.7 (a)

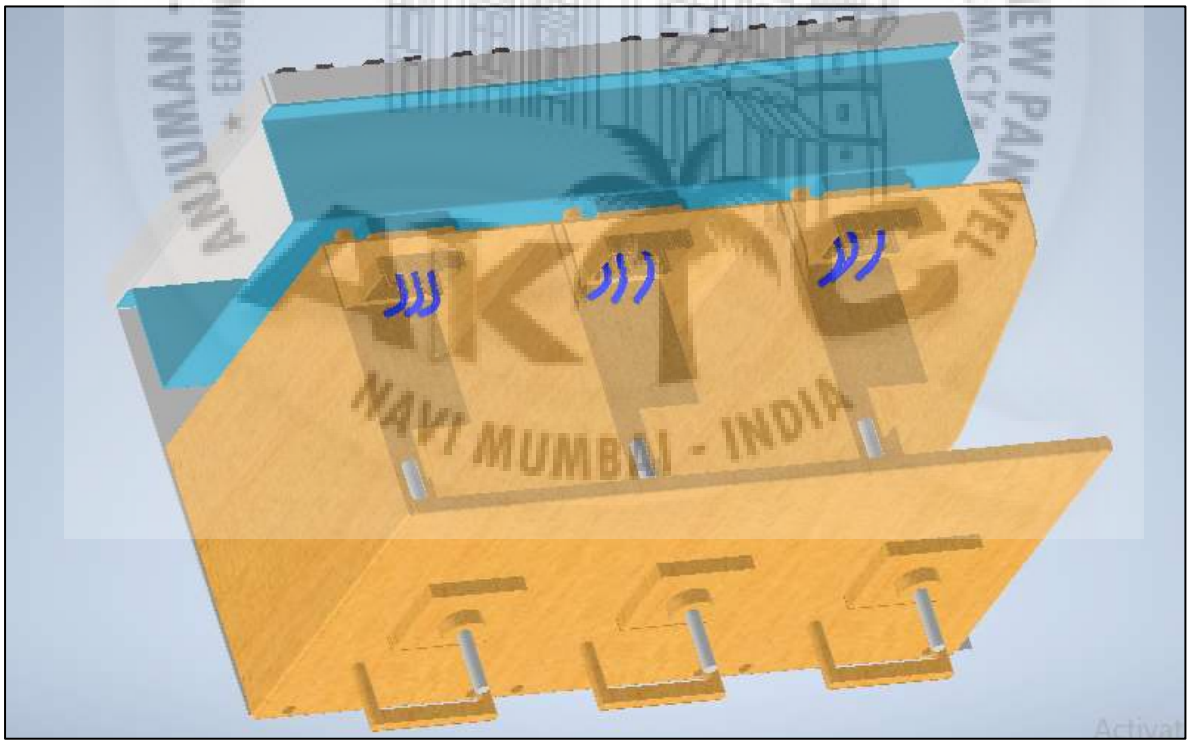


Figure 4.3.7 (b)

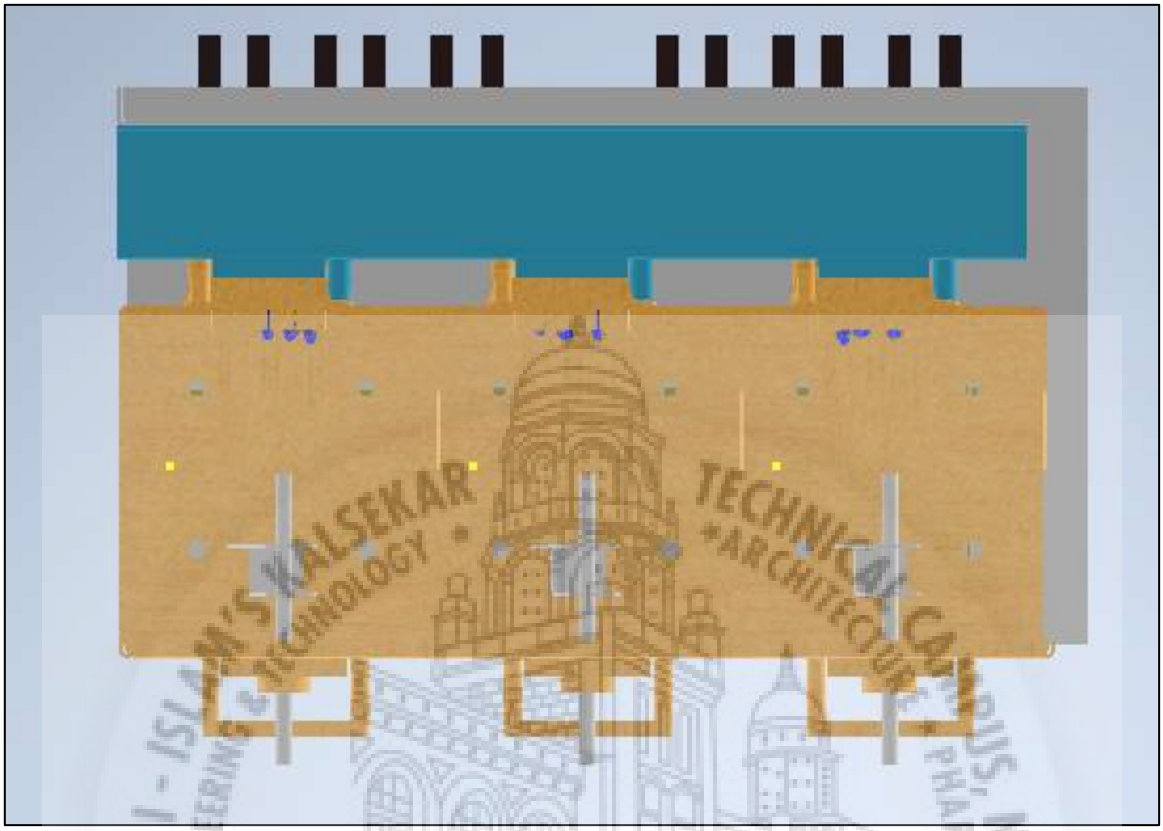


Figure 4.3.7 (c)

- Fully compartmentalized design.Draw out trolleys/module incoming and outgoing power and control contacts automatically also late without manual disengagement in three distinct
- Position i.e. service, test isolate. All Draw out units are fully interchangeable.
- Totally enclosed vermin and dustproof.safety shouters provided accidental contact from vertical bus bars.
- Self aligning and disconnecting power and control contact.
- New design provide top and bottom guide along with swiveling lever for easy module withdrawal without tools.
- Modular construction with wide choice of compartment size.

- Further this system improve better utilization of equipment plate and total interchangeability of trolleys.
- Spring loaded scraping earthling provided with first make and last brake arrangement.
- Maximum eight numbers auxiliary bus bar center provide in top chamber and segregation from HBB zone.
- Large cabling space with adequate cable supports, are provided in CBC.
- Incoming and outgoing stab in type power contacts up to 800Amps. Provide very large range of feeders of different types.
- WIRING : The entire wiring is done with high grade bright copper annealed standard PVC or FRLS or HR FR insulated flexible wires. Control wiring is carried with minimum 1.5 sqmm Gray wire & CT wiring is done with 2.5 sqmm Gray wires. DC wiring is done with 2.5 / 1.5 sqmm white wire. All doors are earthed with the help of 1.5 sqmm yellow green wire.. Electronic Card signal wiring is done with 1 sqmm Shielded wire.
- BUSBARS : Non-insulated or insulated high conductivity copper/Aluminum busbars with neutral are housed at the top section of the cubicle. The main busbars are mounted and supported on SMC busbar supports. The busbar chamber is housed in a separate compartment on top of the cubicle with facilities for segregation. Maximum temperature rise is less than 70°C on an ambient of 40°C.

CONCLUSION

- TO MINIMIZE THE TIME AND TO GET THE MAXIMUM OUTPUT WORK WITH THE HELP OF 3 IN 1 DRAW OUT PANEL
- TO INCREASE EFFICIENCY
- TO REDUCE THE PRODUCTION COST

FUTURE SCOPE:

- REDUCE SYSTEM INSTALLATION AND COMMISSION COST
- REDUCE MAINTENANCE COST
- REDUCE ENERGY MAINTENANCE COST
- REDUCE DOWNTIME
- INCREASE SYSTEM EFFICIENCY
- INCREASE SYSTEM INFORMATION

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Following are the literature and theories that assisted us to study our project

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