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TITLE:
IIOT BASED INTEGRATED PACKAGING SYSTEMS

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With the rapid growth scenario, it is impossible to deny that yet another Industrial Revolution is coming. This revolution will be the era of smart industries, Internet of Things, machine learning and artificial intelligence. This will be the era of industry, when the real and virtual worlds will intertwine beautifully and be governed by Internet of Things. Industrial production of the future will be characterized by the strong individualization of products under the conditions of highly flexible (large series) production, the extensive integration of customers and business partners in business and value-added processes, and the linking of production and high-quality services leading to so-called hybrid products.

Three trends are evident in this industrial revolution:

1. **DIGITISE**- Every single machinery, be it large scale or small will be digitized, smartly controlled and highly interactive.
2. **INDUSTRIALIZE**- An obvious trend as with all industrial revolutions, maximum industrialization and automation are its objectives.
3. **OPTIMISE**- Innovative manufacturers recognize that enhancing the manufacturing process for even simple products presents new opportunities for growth.

The basic idea is to implement concepts of IIOT BASED INTEGRATED PACKAGING SYSTEMS is highly flexible, easily customizable and takes care of the E&Eco-factory concept of Mitsubishi.

OUR AIM:

According to our proposal industrial packaging boxes are those boxes which are used in industrial products where they can keep their product safely with increase in demand of these boxes .Our idea is to develop in standard quality of industrial packaging boxes. During this command given by instructor to machine by using innovative idea of developing IOT which make smart packaging system which can be control by user demand (which they want) from the process.

We have taken an example of a plant in which there is packaging of boxes. Process is start by given command to controller, inside the process boxes are categorized into different logo are placed in station and are arranged automatically in a vertical storage system. These boxes are feed by some external force (through piston actuation mechanism) which bring boxes into conveyor. During this process detection boxes will occur by using proximity sensor which perceive boxes and give command as an input to the user(either box is present or not inside a station) . Then it will move towards vision sensor to identify boxes in accordance of user image processing technology use in automation technology. There is checking and sorting application are derived in which it selective boxes (user demand) segregate and require boxes are forwarded by conveyor in single platform (collection of boxes). After that collecting boxes in platform it

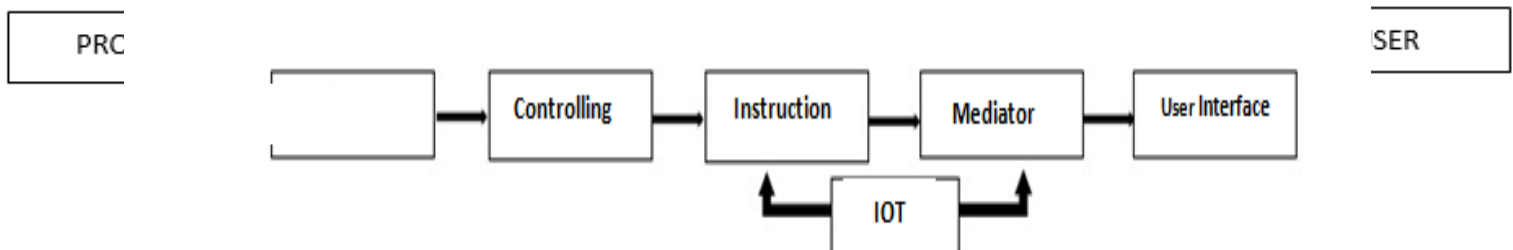
bring in to combination of boxes (make bundle) by pick and place method using gripper (robotic arm) carry boxes from one position to another position inside a setup. This combination of boxes are collecting and packaging in to bigger box (container). This is whole process of packaging that happens inside industry.

The Implementation of internet of things will help us to monitor collection of boxes in container (bigger box). Also as per our requirement we can alter the locations of these containers through IOT. Basically our task is to develop IIOT in industries in which it works in accordance of user demand in such a manner-

1. First of all we can control production rate by controlling speed of conveyor which develop E&Eco-F@ctory concepts using IOT. This will happen by giving command as per user demand of boxes they want.
2. Arrange different boxes with different logo can be detected using vision sensor (data given by IOT) to make sorting method by developing technology of image processing.
3. Number of boxes require to make a bundle (collection of boxes) by giving command using IOT as per demand of user can be done by this process.
4. Number of bundles (collection of boxes) require in container (bigger box) by giving command using IOT as per demand of user can also be done by this process.

Basically IOT works on such an innovative idea to develop E&Eco-F@ctory concepts in accordance of user demand.

APPROACH TO DEVELOP IIOT



Explanation of Block diagram

PROCESS- Inside this we have to explain whole working process related to packaging inside industry. There is arrangement of boxes in vertical storage system which work with input task by proposing some command such as-

1. There is passing of different types of boxes (with different logo) which are placed in a station and come in contact with conveyor as shown in fig 1.
2. During the process of bringing boxes into conveyor can be checked using proximity sensor. There is lots of different boxes are placed inside station (which type of boxes

user want) can be detect by using this sensor .This sensor basically works to sense boxes and gives command to piston so consequently boxes come in contact with conveyor.

3. When conveyor move with boxes in forward direction and come in contact with vision sensor, logo detection process start by using image processing and then process of sorting will occur.

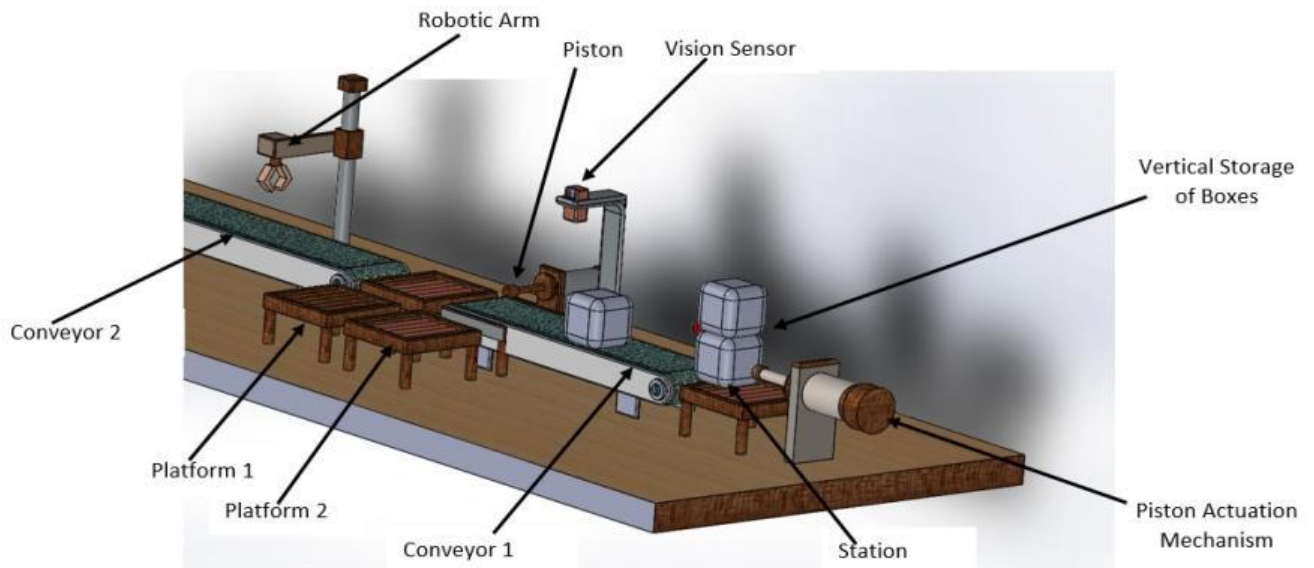


Fig: 1

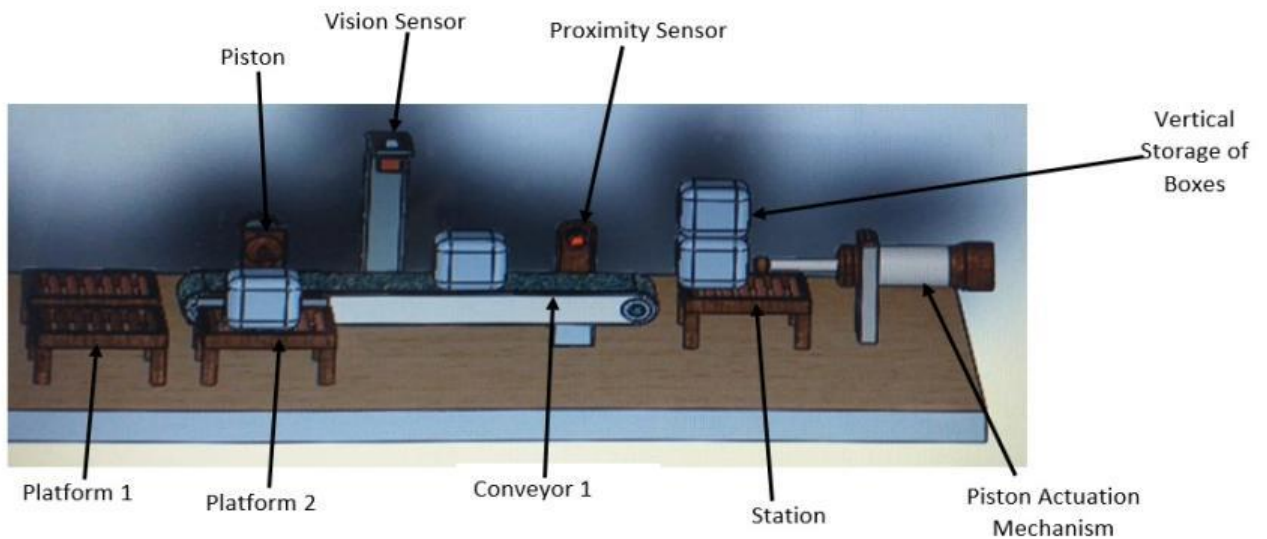


Fig: 2.

4. These boxes (in accordance of user demand) are segregate by vision sensor to follow process of sorting by using image detection method. This process will occur in following way as shown in fig 2-
 - a) Boxes in accordance of user demand are separate out from different type of boxes (different logos) by image detection using vision sensor and collected in a platform 1 as shown in fig 3.
 - b) And remaining boxes which are not required as user demand are collected in the platform 2 as shown in fig 2.

Selection Process :- Under the selection process achieved by using Remaining boxes (not considered as user demand) are collected in other vision sensor and isolation of boxes occur with different no. of boxes.

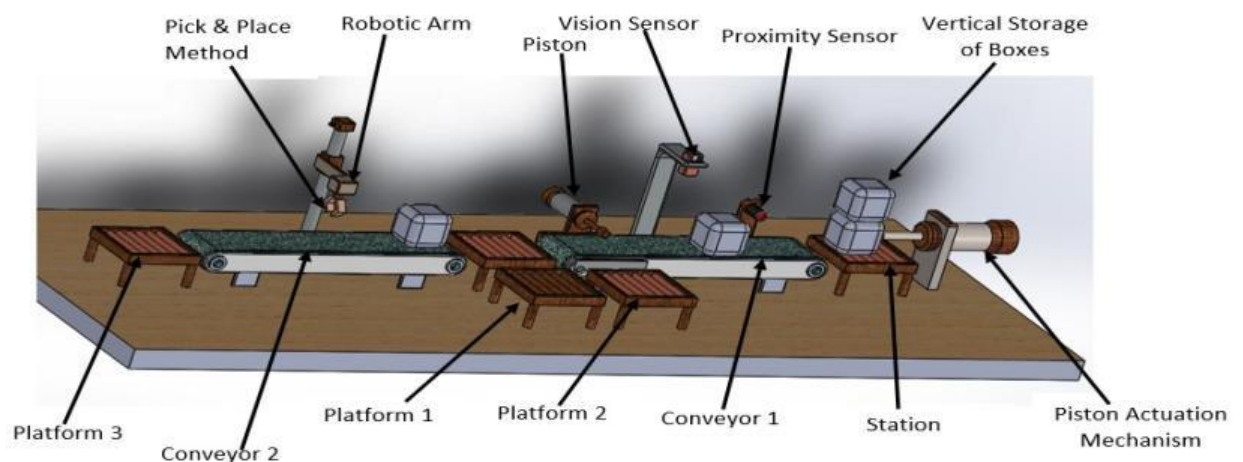


Fig: 3

5. Packaging process:-

- a) Selected boxes which are in platform 1 are collected in a bigger amount. There is task of packaging box by using robotic arm (as a gripper) which works with the help of pick and place method in which it will stock up boxes from platform 1 to conveyor and then collection of box in to platform 3. The arrangement of boxes as per user demand (user want) in a platform 3 and it start packaging boxes in form of bundle in accordance of user requirement as shown in fig 4 and fig 5 .

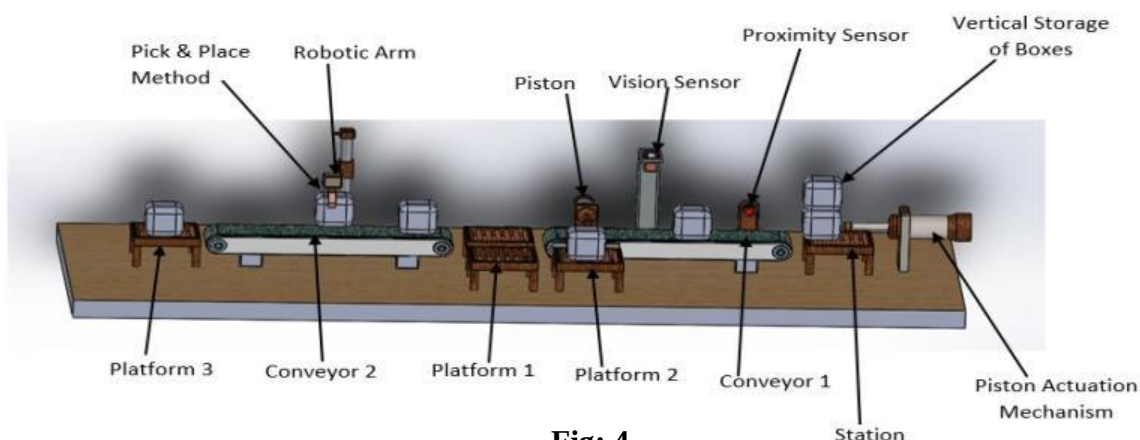
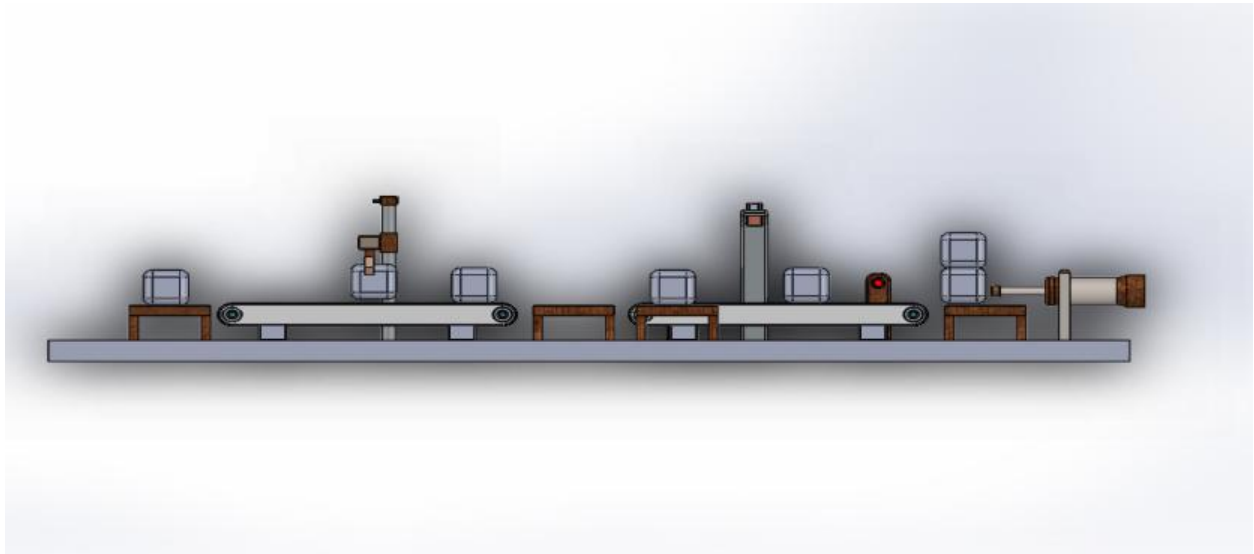
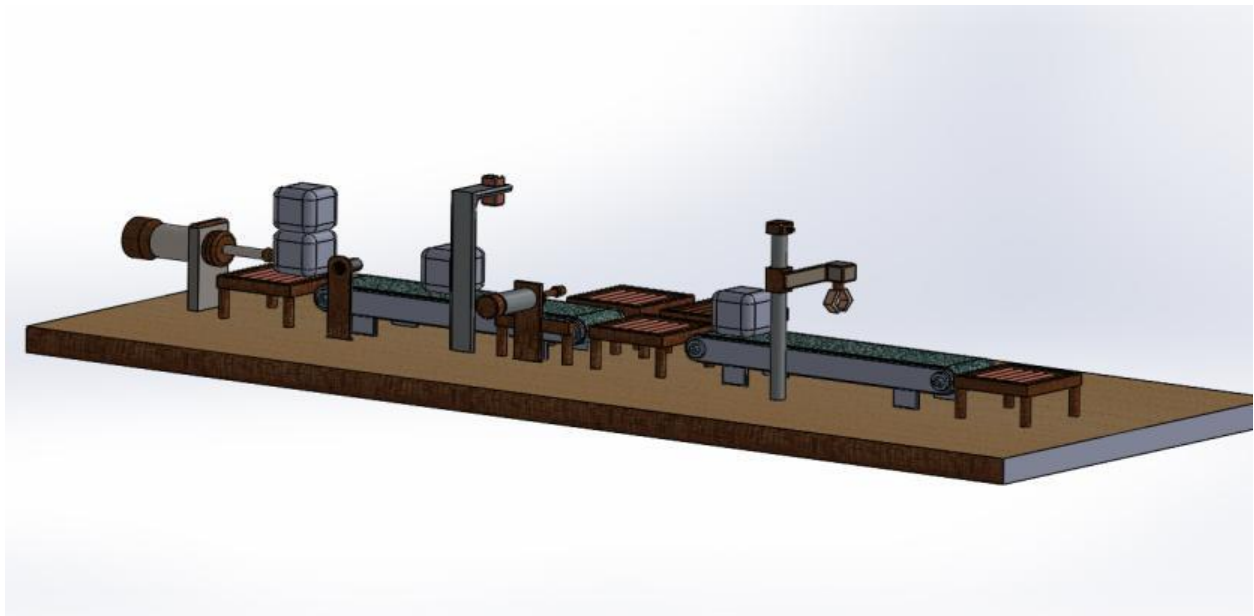


Fig: 4



Whole process in Fig: 5.



Whole process in fig:6.

Idea to build IOT in such manner-

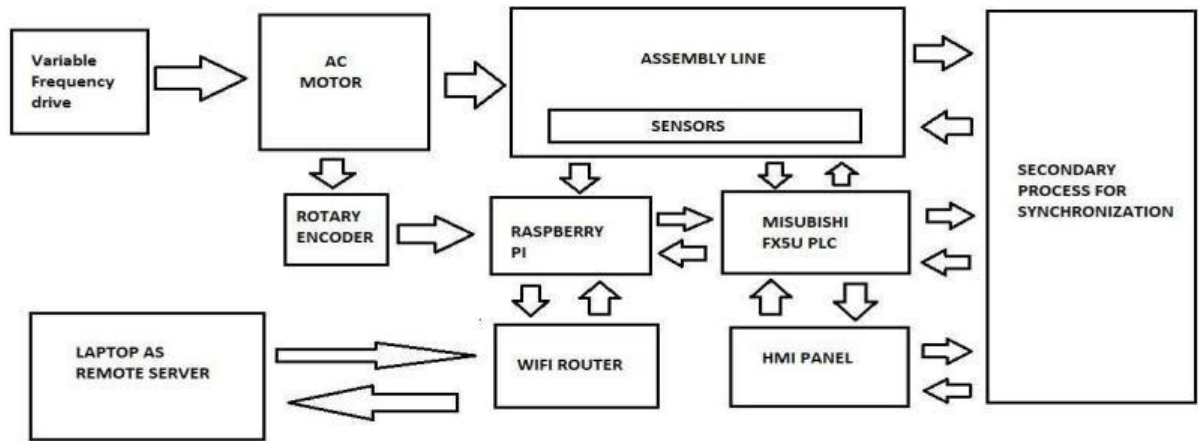
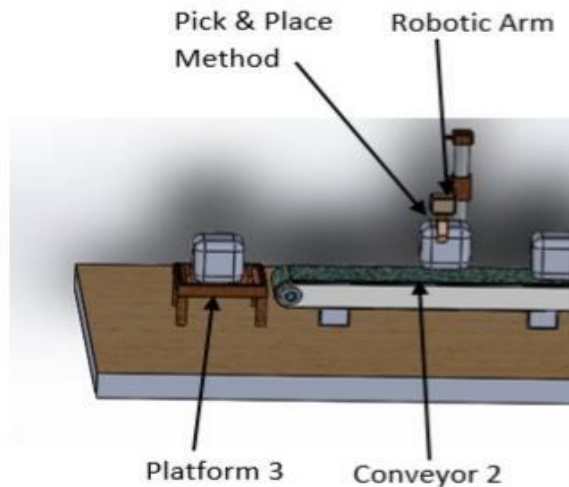


Fig: 7

CONTROLLING:-Basically controlling occur by using PLC communication to process. It can be achieved by using several methods such as –



PLC to PLC communication: - Inside this communication process one of PLC act as master and another PLC act as slave, there is a communication protocol used to communicate both plc so that it will command to the conveyor as well as robotic arm which works under instruction to process as per user demand. This communication helps in controlling rate of production (by controlling speed of two conveyor) in reference of demand of user in packaging system. This can only be achieved by giving Command to the Robotic Arm and conveyor. Robotic arm (just like a gripper) works on pick and place method and its controlling occur by using command given by user as their demand for making packaging bundle which can be control by given instruction to the actuating rodless cylinder by using PLC .

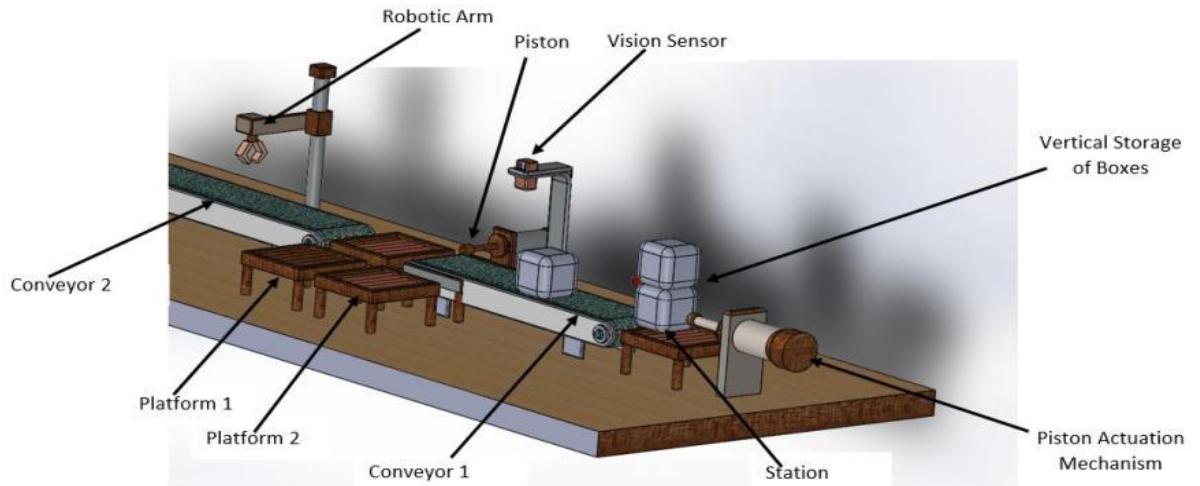


Fig: 7

INSTRUCTION:-User demand can be achieved by giving commands as per user want. This can be processed by communication user with hardware process. There create a part of communication between PLC and raspberry pi which occur using –

- a) **Raspberry Pi:-**Basically it is a smaller computer which gives instructions in according of user to process in accordance of user requirement such as - The production rate, number of products (boxes) as they want and packaging process (in which no of boxes they require) .The whole instruction can be followed by giving command using interfacing hardware device with software device and interact by giving instructions. So that process will continue as per demand of user.
- b) **IOT** basically works with user demand as “what they want” and “how to communicate with process”, whole working mechanism can be achieved by using this technology develop as an innovation part in industry.

MEDIATOR:-It is a way by which instruction can be given by using internet from user to hardware process this mainly done by Wi-Fi communication protocol . For achieving this we require –

a) **Wi-Fi router:-** - Wi-Fi router works on providing wireless communication in which it gives IP address which is help to communicate one device to another using this protocol.

b) **Server:-**Server is used to provide service in accordance of user requirement to the hardware process. It is virtually store data by using collection of various data system where large no. of data is collected and provide communication between users with hardware device through some mediator which is called internet. This will help in providing instruction as per user demand in packaging system in automation industry.

USER INTERFACE:- Basically we are using GUI (graphical user interface) develop through web developing and also we can generate APP development so we can command by interfacing of user with hardware process which works only by giving command from user .This will provide a single web where user can demanded their demand by given command as per their requirement .

NECESSARY HARDWARE REQUIRED-

1. VFD (variable frequency drive).
2. AC MOTOR.
3. Assembly line Station.
4. Vision sensor.
5. Mitsubishi FX5U PLC
6. Pneumatic gripper.
7. Raspberry Pi (with 16 GB class10 memory card and power cable).
8. Laptop (for remotely controlling the process).
9. Relay (5-10, according to requirement).
10. Connecting cables and Electric wires.
11. Wi-Fi router.

SOFTWARE REQUIRED-

1. GX Works 3 or 2.
2. Raspbian (OS for raspberry pi).
3. Putty.
4. VNC server.
5. HTML (hypertext markup language).
6. CSS (cascading sheet style).
7. JavaScript.
8. PHP.
9. AWS (Amazon web server).
10. Apache server.

Technologies that will be used in this project are-

1. Ultimaker 3D printer.
2. Mitsubishi PLC & HMI.
3. Sensors like capacitive, vision from Pepper & Fuchs.
4. Pneumatic actuator from Janatics.
5. Solid works for 3D drawing.

BASIC COMPONENTS USED TO COMPLETE ASSEMBLY PART

1. Aluminum profiles and sheets.
2. Conveyor Belt.
3. Pneumatics Actuator.
4. Directional Control valves.
5. Filter Regulator Lubricator – FRL.
6. Sensors – for detection process.
 - a). Proximity sensors.
 - b). Vision sensors.
8. Power Supply.
9. Reed Switches.

SOME TECHNOLOGIES USED INSIDE THE PROJECT -

1. The assembly line processes will be controlled by plc. The logic for plc can be designed according to the requirement. The connection between plc and raspberry pi will be made using cables. As the output voltages of plc and pi are different, relay will be used between wires for setting up connections.
2. The conveyor belt will be driven by ac motor (induction motor) connected to variable frequency drive (VFD) and rotary encoder to monitor speed.
3. Different P&F sensors will be installed at different steps on the assembly line to monitor and fetch real time data of the process. This data will be received by raspberry pi that will then transmit this data to remote server via Wi-Fi router.
4. Data transferring mechanism used during PLC to PLC communication where gripper communicate in reference of conveyor and understand process of processing.
5. Data transferring mechanism is also used in storing data inside a server and provide task in accordance of user requirement.
6. The process output will be displayed on a HMI panel placed near the setup.