

“PLC BASED COURIER PARCEL SORTING”

A Report

Submitted in Partial Fulfilment of the Requirements for special assignment of

21COE51 PROGRAMMABLE LOGIC CONTROLLER

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Abstract:

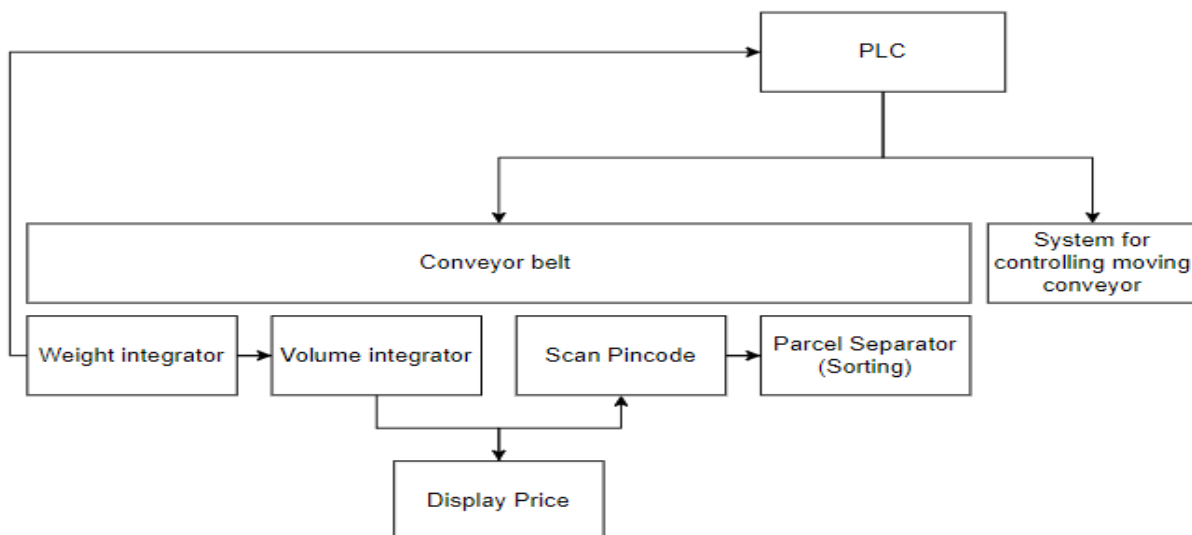
In this advance era, automatic sorting is highly desirable in approximately every industry. Its main objective is to reduce human efforts and time which can ultimately raise its efficiency. However, perfect sorting machine is still in progress which should be flexible and compatible in design. In this work, the proposed sorting machine is able to corporate compatibility by using conveyer belt and proximity sensors to detect type of material i.e. wood, metal or plastic and also identifies size of material in three different ranges and finally sort the material separately in assigned basket by using pneumatic cylinder (controlled by Programmable Logic Controller (PLC)). The proposed multi sorting system is able to sort nine objects of nine different ranges are sorted with 100% accuracy within the time interval of 0.5 seconds. The proposed model could be implemented in any industry whose applications are mechatronics based engineering system. This model can also produce list of sorted objects through enabled sorting program commands.

Introduction

With the advancement of society, online shopping has become an indispensable aspect of modern life as a means of consumption, but the logistics industry is under enormous pressure to voice a new need, the urgent need for a package sorting system to increase labor efficiency and speed up logistics. Package sorting, which involves sorting a large number of parcels according to their destination and assigning them to the appropriate work area, can be split into three categories: manual sorting, mechanical sorting, and automatic sorting. However, there are many other ways to sort parcels, each with its own advantages and disadvantages. Sorting by height is another common method of parcel sorting. This method involves using sensors to measure the height of each parcel as it passes through the conveyor. The system can then sort parcels based on their height into different bins. This method is particularly useful for sorting parcels that are irregularly shaped or have varying sizes. However, it may not be as effective for sorting parcels that are the same height but have different weights. Sorting by size is another method that can be used in parcel sorting. This method involves using sensors to measure the size of each parcel as it

passes through the conveyor. The system can then sort parcels based on their size into different bins. This method is particularly useful for sorting parcels that are similar in weight and height but have different dimensions. Sorting by material is yet another method of parcel sorting. This method involves using sensors to identify the material of each parcel as it passes through the conveyor. The system can then sort parcels based on their material into different bins. This method is particularly useful for sorting parcels that have different properties or require different handling methods. In order to increase efficiency and accuracy, it is possible to combine several types of sorting systems in the same sorting process. For example, a two-parcel-sorting system could involve sorting parcels first by weight and then by height, while a three-parcel-sorting system could involve sorting parcels first by weight, then by height, and finally by material.

Block diagram:



Objectives:

The objective of this paper is to describe the process of PLC-based parcel sorting in industries. Automatic parcel sorting systems are critical for courier firms with large distribution capacity and short delivery times, and courier companies must improve the quality and reliability of their services as customers seek faster deliveries. Many courier businesses perform parcel sorting and placement manually, which is time consuming and inefficient. We decided to make it easier for courier firms by designing a system that performs all of these tasks without the need for human intervention. One of the essential projects for courier corporations is our proposed project, an automatic parcel sorting system based on PLC.

Hardware Requirements:

- Phase AC induction motor
- Proximity Sensor
- Gear box
- Encoder
- Variable-Frequency Drive (VFD)
- Start-STOP Button
- Emergency Stop

Software Requirements:

- TwinCat



I/O LIST AND ADDRESS LIST:

Input	Address
Start	%IX0.0
Stop	%IX0.1
WEIGHT	%IW2
HEIGHT	-
LENGTH	-
WIDTH	-
IS_URGENT	%IX0.2
PINCODE	%IW4

Output	Address
CONVEYOR	%QX0.0
TOTAL PARCELS	-
LOW_D	%QX2.0
HIGH_D	%QX2.1
LIGHT	%QX2.2
MEDIUM	%QX2.3
HEAVY	%QX2.4
W_CHARGE	%QW12
TOTAL_CHARGE	%QW14
WEIGHT	%QX0.1
City Code	%QW10

1.2 Components used in the Project

- Conveyor belt
- Induction motor
- Weight Integrator
- Volume Integrator
- Barcode Scanner(Camera)

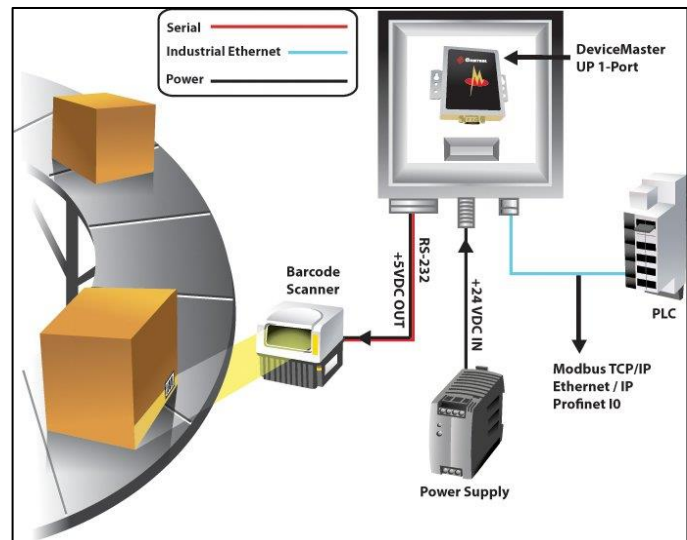
Full Conveyor Diagram:



Weight and Volume Sensors:

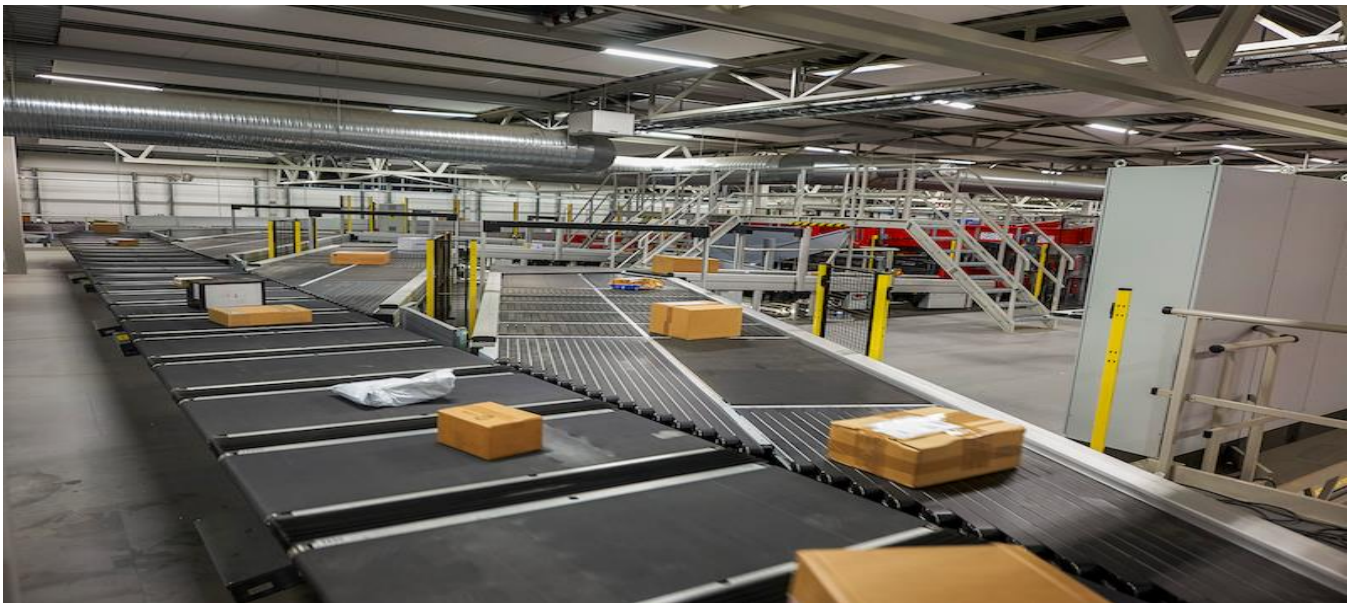


Barcode Scanner:

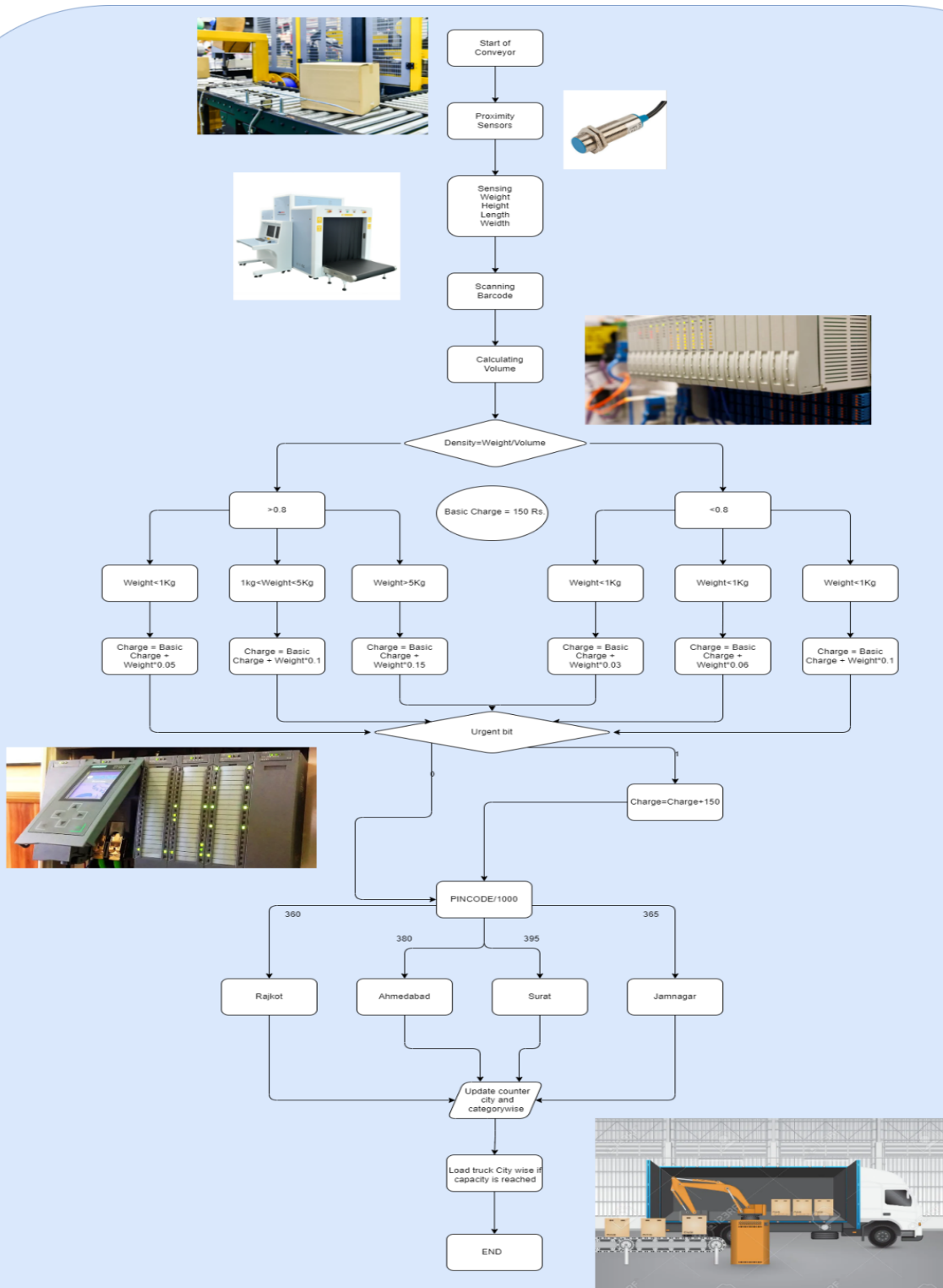




CONVEYOR PARTITION:



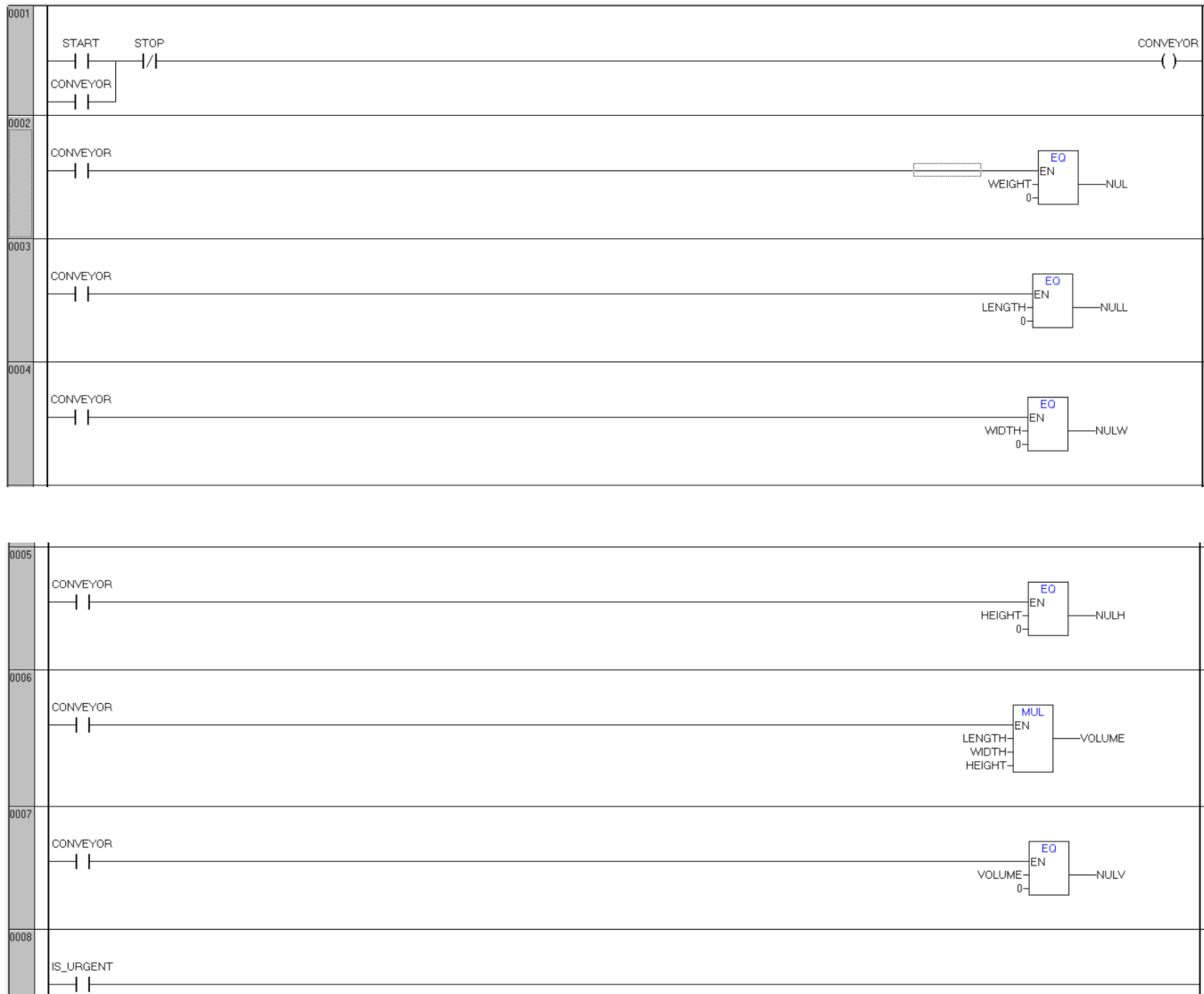
Program flow chart:



Ladder Diagram:

START / STOP OPERATION AND TAKING ALL INPUTS AND CALCULATING VOLUME

We will take weight, length , height, width as input (scanned by barcode) then calculating volume from given values. Also taking input whether parcel is urgent or not.



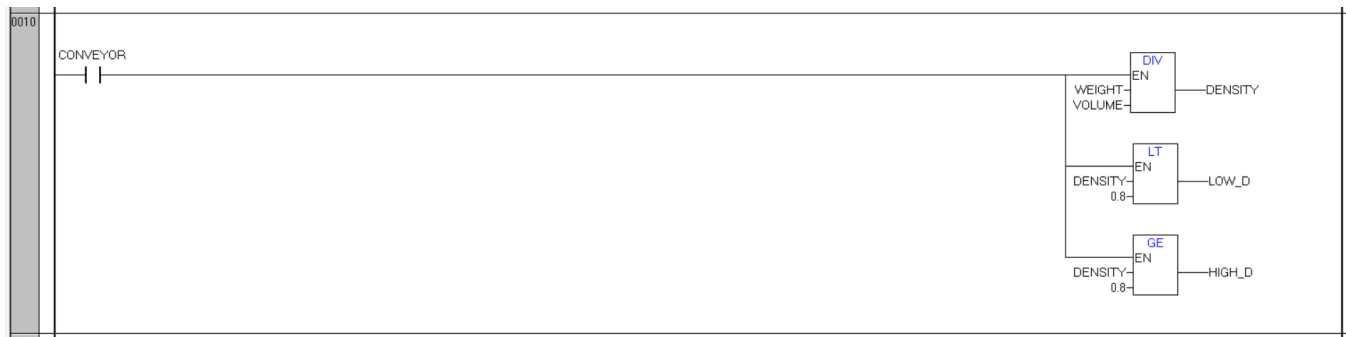
SCANNING CITYCODE AND URGENCY (Calculating city code and finding destination city)



CLASSIFYING PARCEL BASED ON DENSITY AND WEIGHT

Density > 0.8 = HIGH , Density < 0.8 = low

Weight < 1kg = Light, 1 kg >= Weight >= 5 kg = Medium , Weight >5kg = heavy



COUNTING TOTAL PARCELS



CALCULATING CHARGES BASED ON WEIGHT AND DENSITY

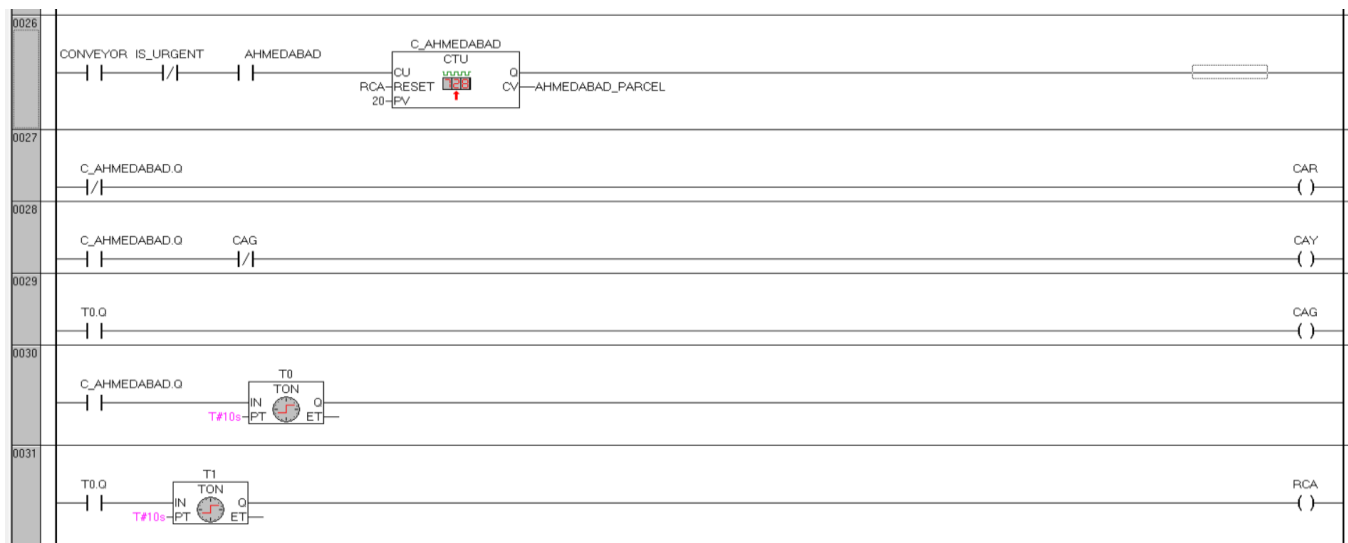


CALCULATING TOTAL CHARGES (ADDING BASE CHARGE + URGENT CHARGE)

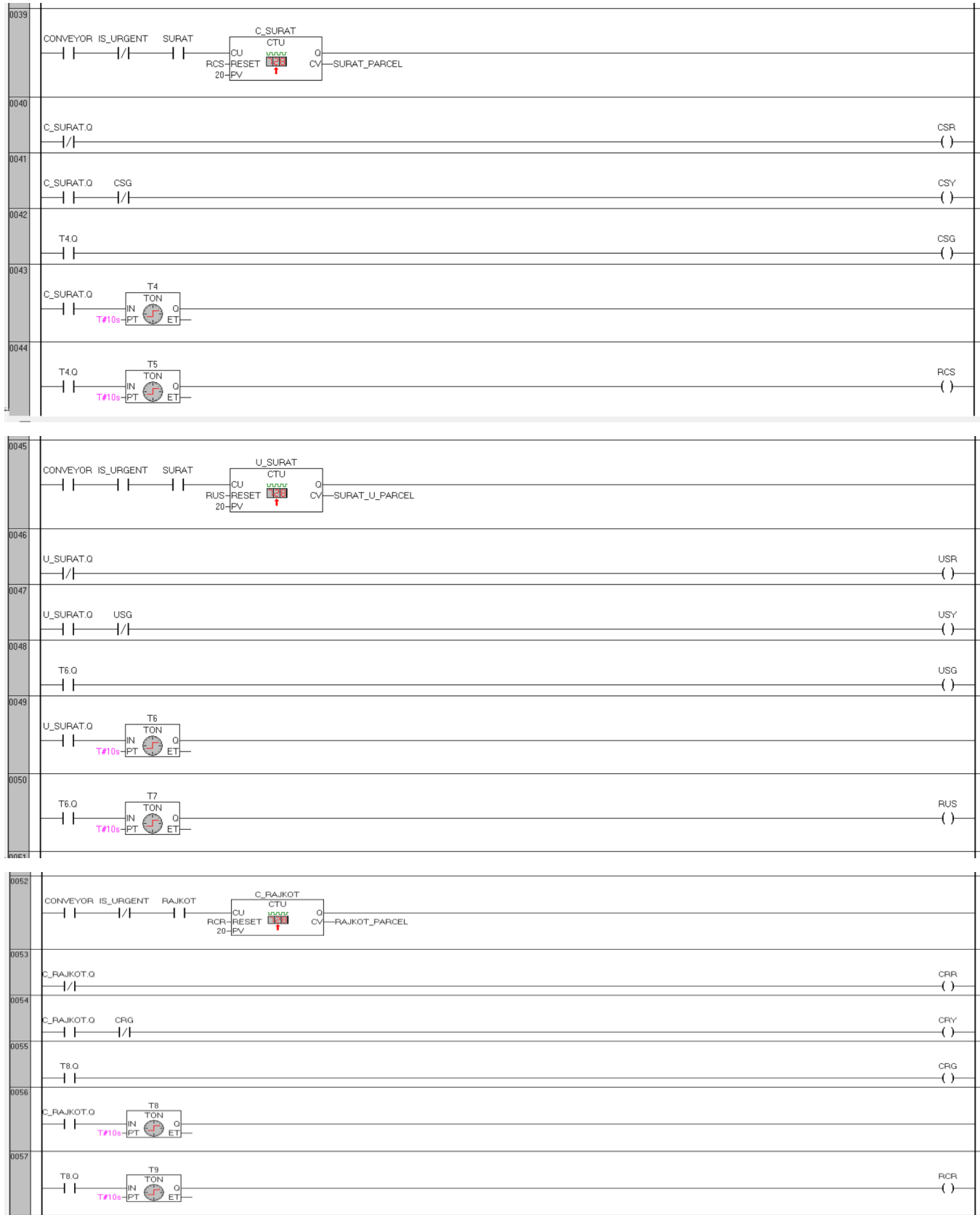


SORTING PARCELS BASED ON CITY CODE AND URGENCY

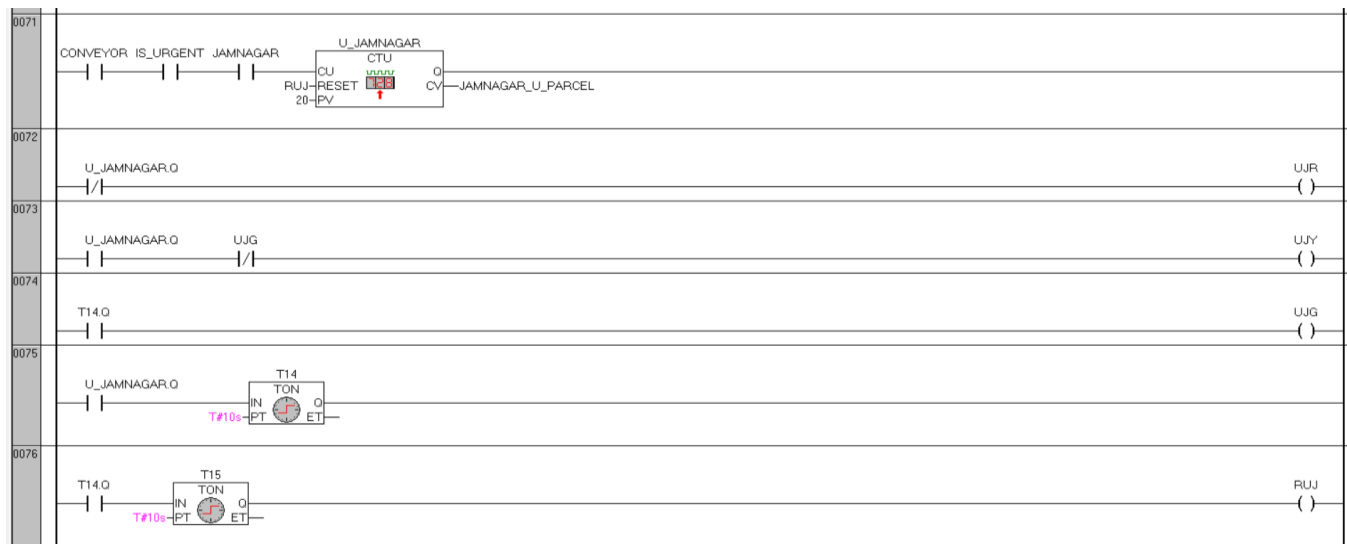
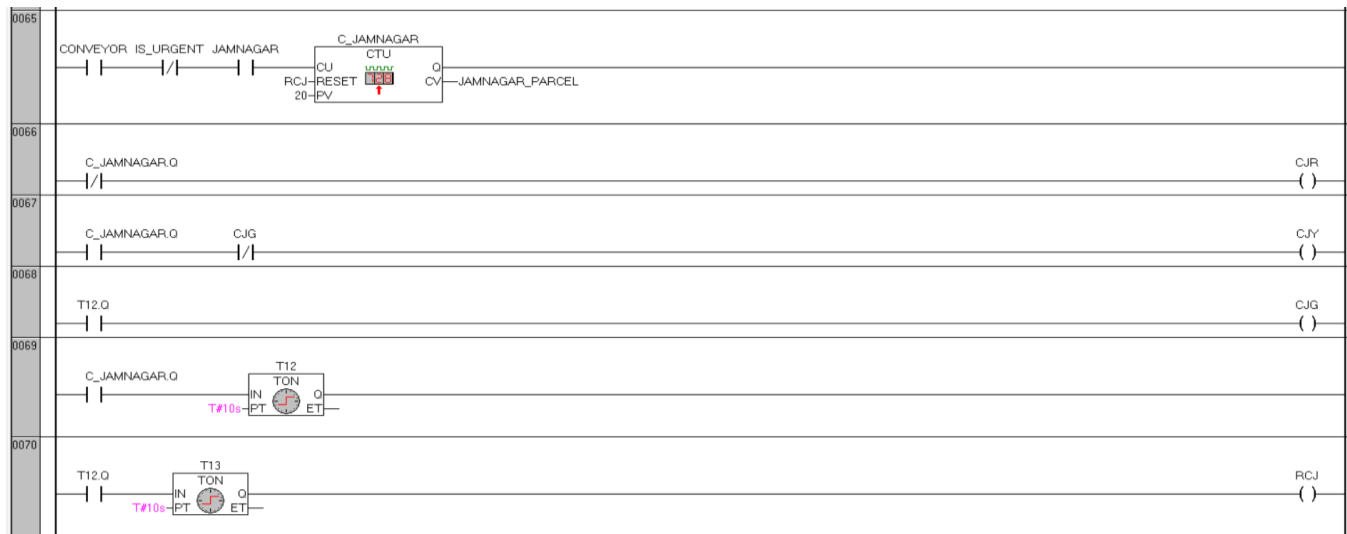
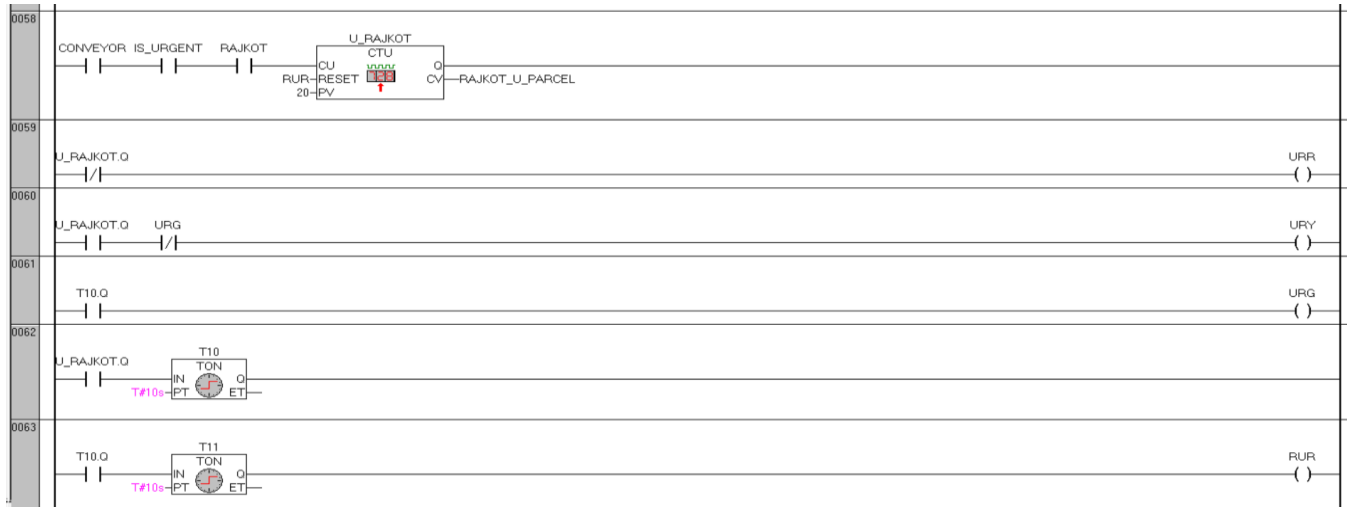
UAR- Urgent Ahmedabad Red	CAR- Common Ahmedabad Red
UAY- Urgent Ahmedabad Yellow	CAY- Common Ahmedabad Yellow
UAG- Urgent Ahmedabad Green	CAG- Common Ahmedabad Green
Red – parcels not loaded, yellow – parcels getting loaded, green- ready for delivery	



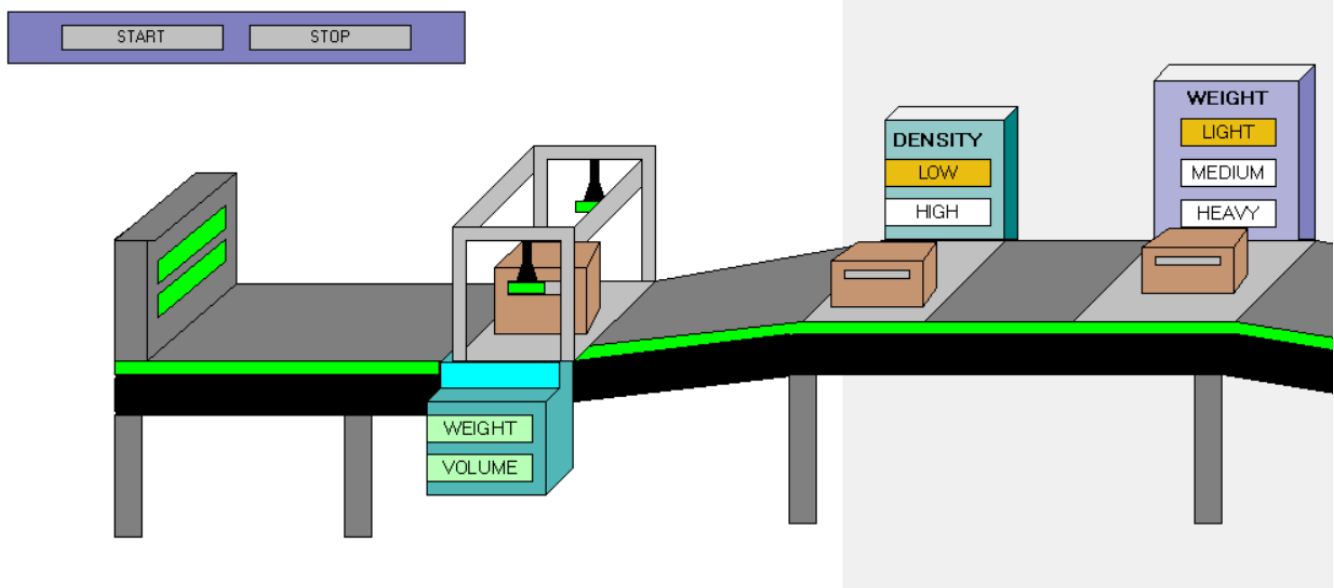
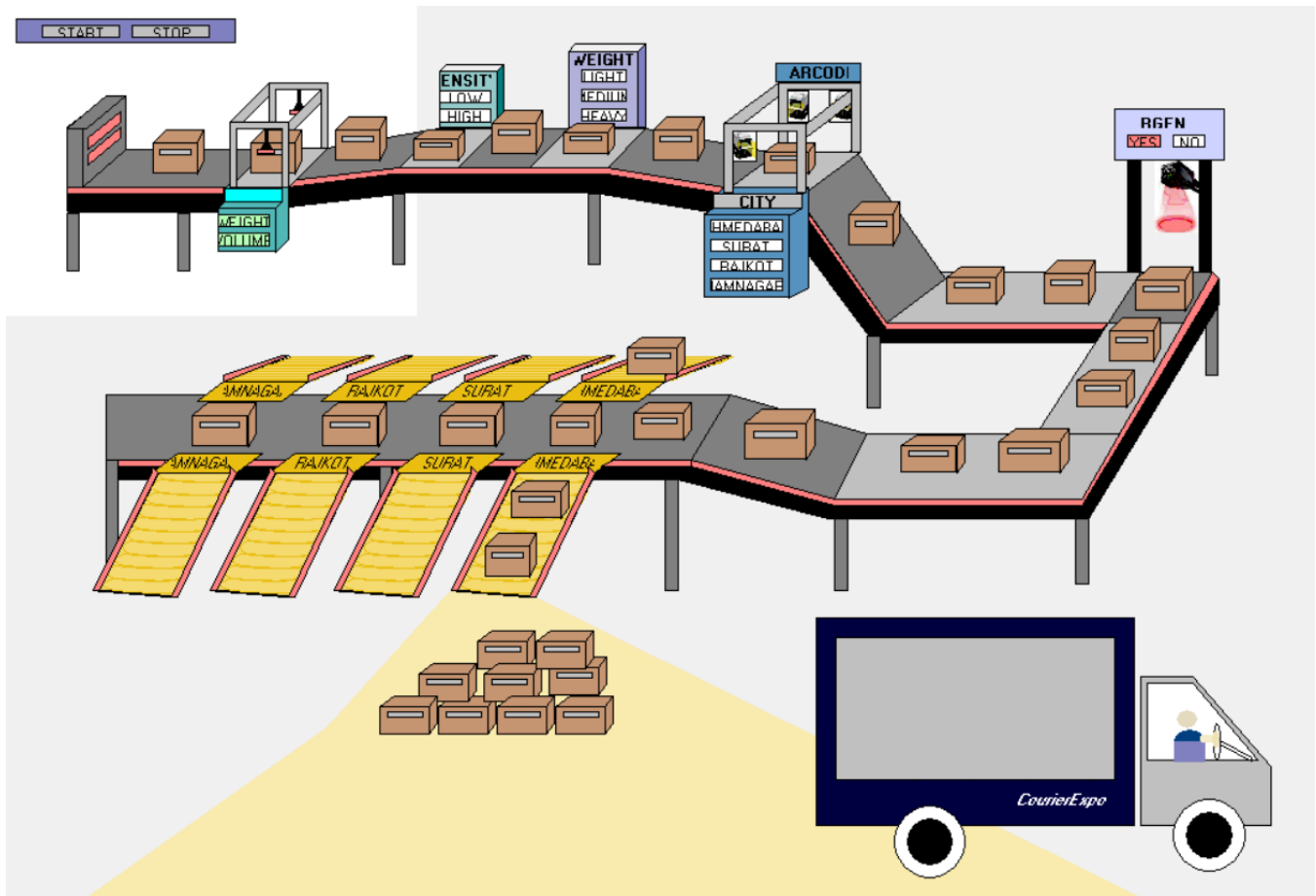
INNOVETIVE ASSINGMENT

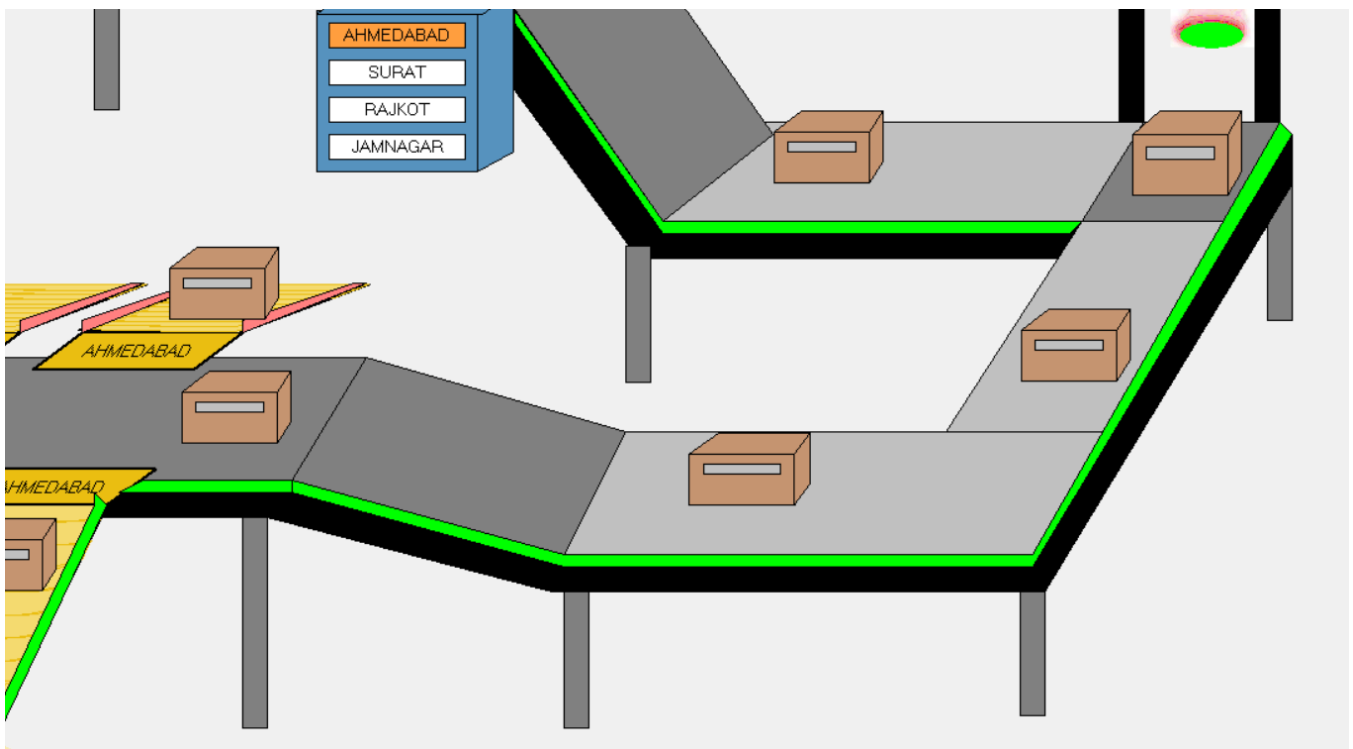
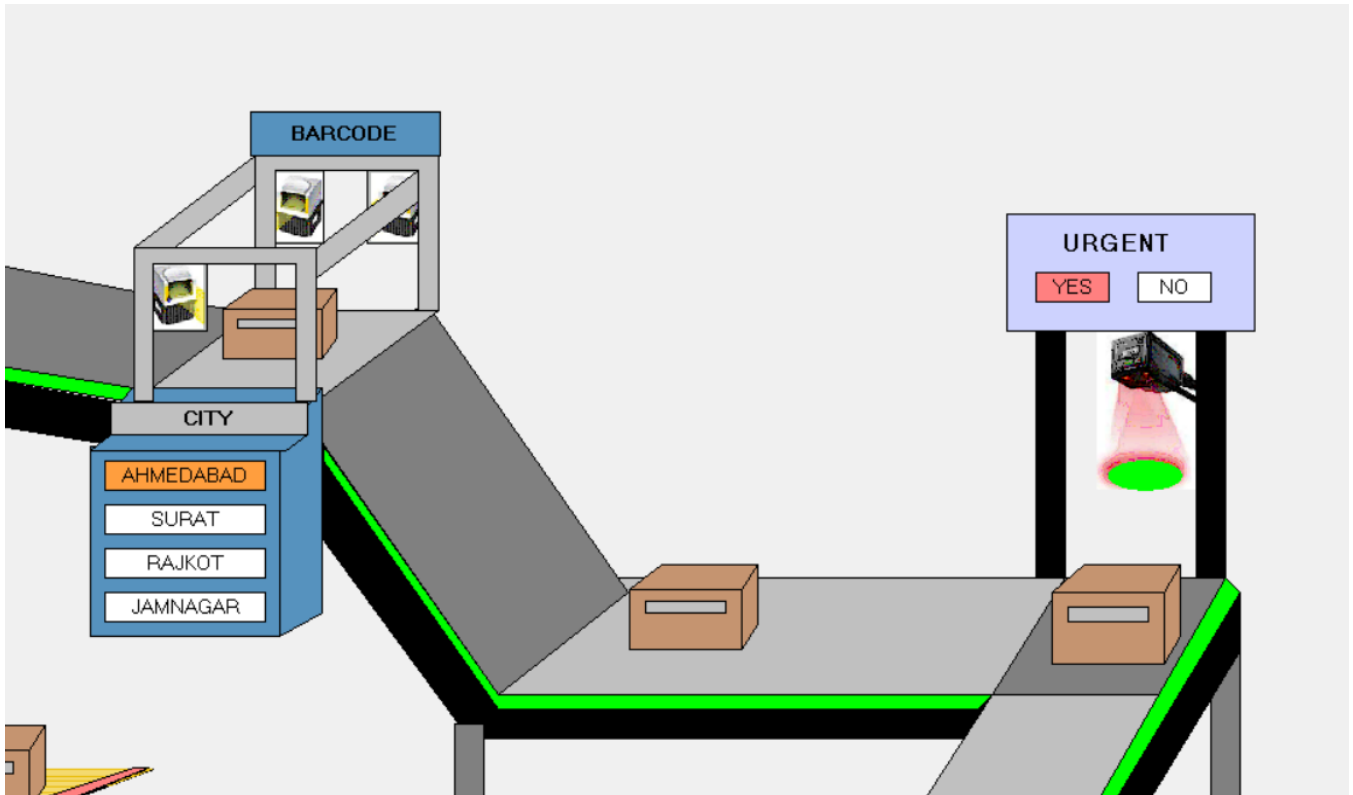


INNOVETIVE ASSINGMENT

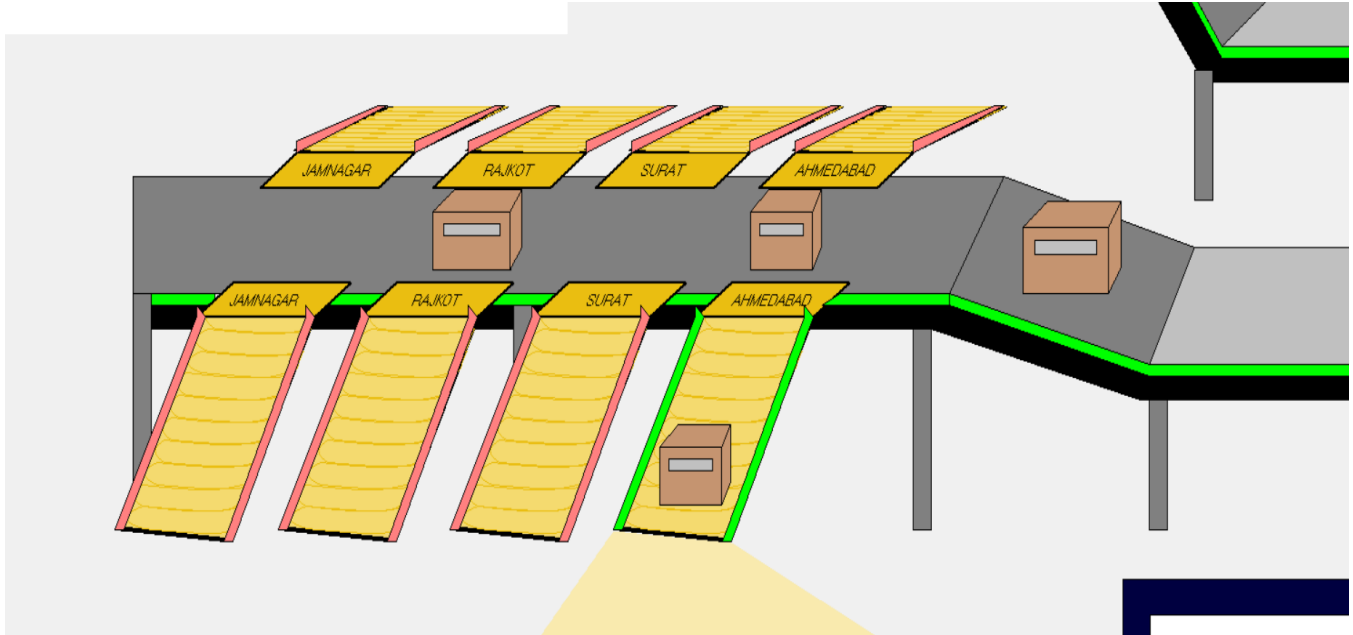


OUTPUT

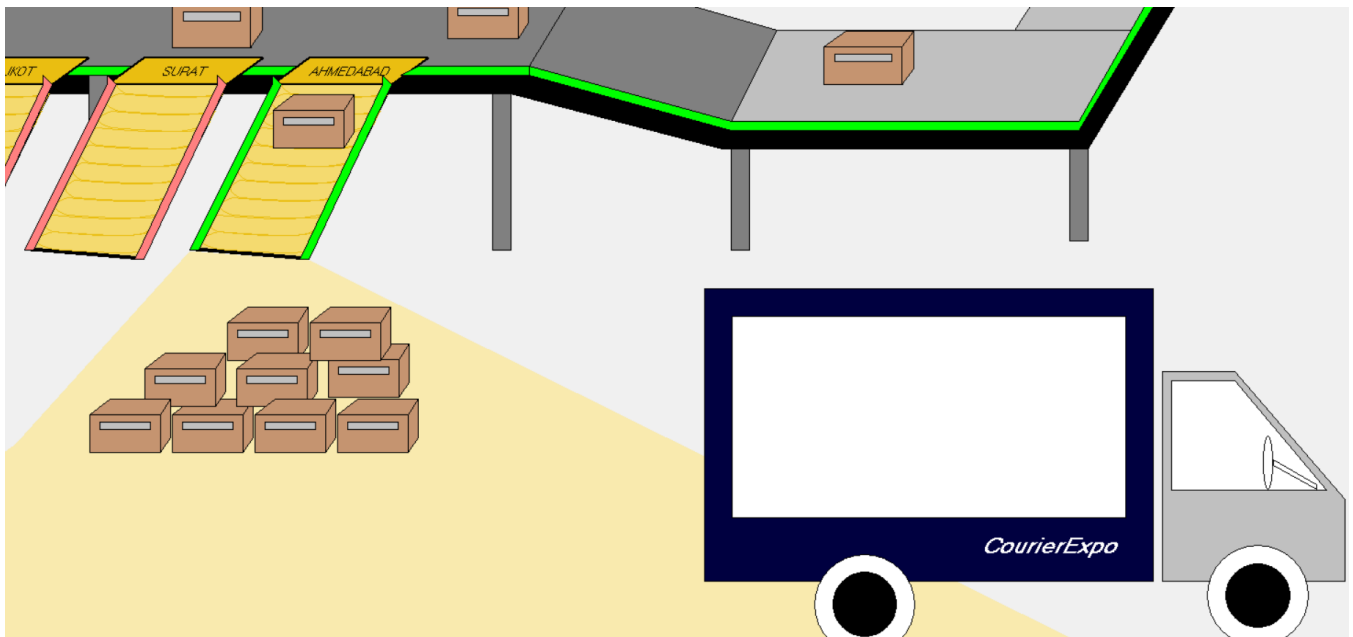




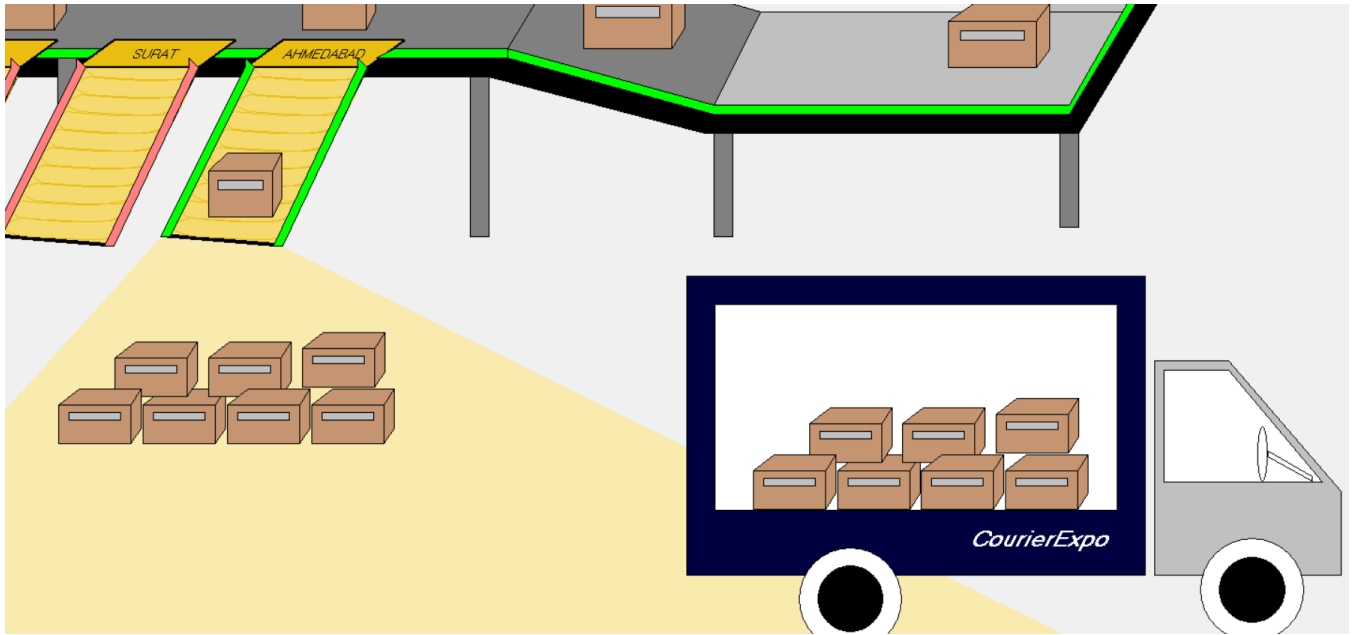
PARCEL SORTING BASED ON SCANNED CITY (GREEN COLOUR)



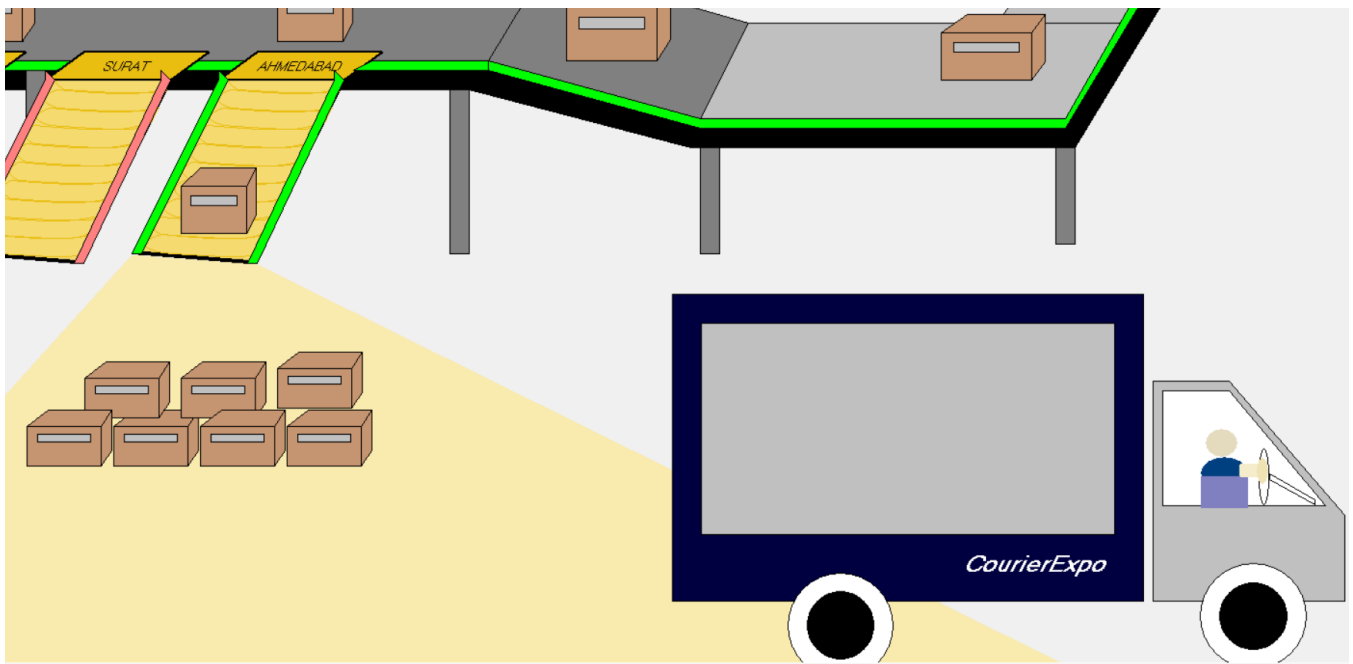
PARCELS NOT LOADED TO TRUCK



PARCELS GETTING LOADED TO TRUCK



TRUCK READY FOR DELIVERY



Future scope:

We created a simple parcel sorting system utilizing the Programmable Logic Controller as a result of our study (PLC). The parcel sorting system is based on the object's weight as it passes through the conveyor. Further enhancements to our work can be made by implementing it in large-scale sectors. The use of programmable logic controllers (PLCs) in the parcel sorting process has numerous benefits, including faster and more accurate sorting, reduced labor costs, and increased efficiency. Sorting parcels based on their weight is just one example of how plc. can be utilized in the sorting process. Overall, the use of plc in parcel sorting systems can greatly enhance the efficiency and accuracy of the sorting process. By incorporating various sorting methods, parcel sorting systems can be customized to fit the specific needs of different sectors, from small-scale operations to large-scale logistics centers.

Conclusion:

As a result of our work, we now know how to categorize parcels based on their weight. And keep track of the different sections, such as light, medium, and heavy. This sorting will be particularly valuable in the courier industry, where weight is a critical factor. Sorting is a crucial step that allows us to readily distinguish between parcels. Automating this process not only reduces the workload on human employees but also increases the accuracy and speed of the sorting process. This means that courier companies can sort a higher volume of parcels in less time, leading to increased productivity and customer satisfaction. Furthermore, PLC-based sorting systems offer unparalleled accuracy and consistency compared to manual sorting methods. They are not affected by factors such as human error, fatigue, or bias, ensuring that each parcel is sorted according to its weight without fail. This leads to fewer miss-sorts and miss deliveries, ultimately reducing costs associated with returns and customer complaints. In summary, **PLC-based parcel sorting systems have been a game-changer for the courier industry. By automating the sorting process based on weight, courier companies can increase productivity, reduce costs, and improve customer satisfaction. The accuracy and consistency provided by these systems ensure that each parcel is sorted correctly and delivered to its destination on time.** With the potential for further enhancements such as sorting by height, size, or material, the future of parcel sorting looks brighter than ever.