

Automatic Parcel Sorting Machine Using RFID

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Abstract: Development in the industrial sector is an everlasting and needful process that leads to better utilization of resources and economic productive environment to develop. Such Development can be seen in the daily activities of industries that use various processes to function. Growth in the industrial estate is largely related to the growth of the nation itself, with many major fast-growing economies and India being one of them there is a huge supply and demand chain of action within the country. The industrial zone incorporates the manufacturing quarter and distribution zone. Various processes are involved in such bodies to function, one of such process is transport and sorting of products that need to be conveyed from one point of disembarkation to another. With the huge requirement of commodities to be manufactured and distributed manual sorting has become liable for the ineffective use of resources at the cost of time and mercantile. This paper suggests the use of RFID tag read technology with conveyor belt mechanism, to sort out and track parcels in real-time in different stages of manufacturing units in industries. Using the radio frequency identification process as the main working principle the project uses RFID as its main sensor which differentiates between different parcels depending upon pin code. The RFID tags attached to objects helps to identify different parcels in different sections of the delivery process. This parcel sorting machine can be used in post offices, delivery services, manufacturing units, etc.

Keywords: Radio frequency identification, RFID tags, Automatic sorting, Servo motor Sorting mechanism, Conveyor belt.

1. Introduction

Radio frequency identification system (RFID) is an automatic technology and aids machines or computers to identify objects, record metadata or control individual target through radio waves. Connecting RFID reader to the terminal of Internet, the readers can identify, track and monitor the objects attached with tags globally, automatically, and in real time, if needed [1].

RFID has the potential to deliver a wide range of benefits throughout the supply chain, including tighter management and control, reduction in shrinkage, reduced labour costs and improved customer service. However, retail users will have to address a number of operational and strategic challenges and consumer privacy concerns before these benefits can be fully realized. The adoption of RFID may further increase structural concentration within the retail sector of the economy, and have a major impact on retail operations at shop floor level and on the customers' shopping experience [2].

US Patent no. 6,878,896 B2 (Braginsky et al.) Describes a Synchronous Semi-Automatic Parallel Sorting System.

“The device comprises: feed conveyors, a Switching unit, optical readers positioned to capture destination indicia affixed to each article; a detached moving display which remains close to the article to be Sorted and presents information of the article's destination location; a destination location which signals when a related article is approaching, and a controller capable of assigning destination locations and controlling display devices.” [3]

The characteristics of the RFID technology though seem perfect but may vary drastically from device to device depending upon various environmental and economic factors. The particular Air interface, frequency modulation, protocols being many factors responsible for it's processing. [4]

ETRI Journal, Volume 28, Number 3, June 2006 (Jeong-Hyun Park et al.) describes a Postal RFID Application Model and System Architecture which can be used for tracking parcels real time and shows implementation of parallel management and parcel processing. The Paper depicts the performance of the Tag reading technology on being mounted on various subjects such as can water and paper for postal logistics [5].

The rise in requirements of humans has deeply influenced the manufacturing process in various industries. With an increase in need of the consumer, there is an increase in industrialization too. An enormous amount of products are being manufactured every day. These products are available in various online shopping websites. Availability of a large variety of products on these websites or apps have made shopping much easier for People and hence demand has increased. Most of these industries transport bulks of these products every day to different locations. Sorting the products based on different locations to be sent as well as on the type of product to be sent has become a tedious task. It not only increases the time taken to complete the process of transporting the products from seller to buyer but also consumes a lot of time. This project of parcel sorting machine was proposed taking into consideration the problems and drawbacks of manual sorting. This project is to design the automatic sorting of the parcel using RFID to separate the parcel according to the different types of products. As per the RFID scanned, the parcel will distribute to the zone container. As we are using RFID instead of bar-code, the box which is used to transport will be reusable to avoid garbage.

Daily millions of products are manufactured in large scale

industries in various geographical locations. Transporting them to delivery services after sorting out different products of different generation sectors when clubbed together can be a tedious process. Initially, labours employed at a sorting facility performed the sorting process that is, this labours don't only have to read reach and every name of the product but also pass it in on to different sorting stations. This manual throughout process creates a lot of errors in simple operation of sorting due to faulty reading or miscommunication. Also places with less population have to use same hands for a lot of tasks which can cause fatigue for the workers leading to miscalculation. Through the answer to this problem is not completely automatizing the system which may cause a single failure in procedure huge amounts of loss. To fully optimize the system, the answer lies with automatic sorting machine which pre-sorts large mixed up sum of parcels before finally passing onto manual forte where human operators segregate the parcels rest of the way.

The Product could use Bar-code and it's reader to sort out parcels but the reasons below indicate why RFID is preferred over bar-code.

Bar-code gets damaged due to wear and tear and constantly parcels being transported from one place to another in the delivery services but RFID usually does not get damaged because of transportation. RFID uses radio waves to transmit information without having any physical contact with the tags whereas Bar code needs proper alignment of the Code with the scanner. Any misplacement of the code with its scanner may result in error. RFID is not limited to space thus can perform objective of tracking the product quickly without delays. RFID system consists of Antenna which acts as a component to transmit and receive information about reading and storing of tags, Tags which contains special identity for specified frequency and reader

2. Analysis of flow of work

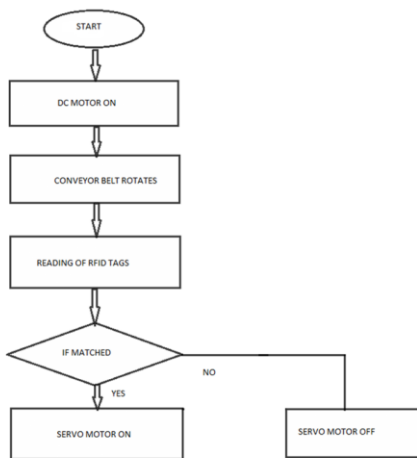


Fig. 1. Flow chart representation of the operation of all the parts on the subject aka parcels

As expressed in figure 1 the process starts with DC motor turning on, the conveyor belt connected to DC Motor starts rotating. Once the Parcels are placed on the belt pass over the RFID reader the reader reads the tags attached to the parcel and checks with the system if the tags have been stored before of not. One of the two outcome of the system is either the tags matches or it doesn't. If the tag matches, then the arm attached to the system using servo motor turns on and parcels is sorted out at the side of the system. If it doesn't then the Parcel moves on further to another stage of either sorting or transporting.

3. Components of system

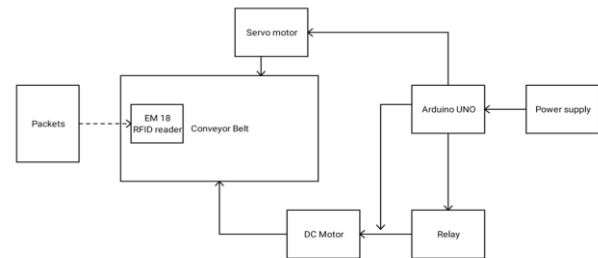


Fig. 2. Hardware model of system

Incoming unit is entry point of the parcels onto the track of the conveyor belt. This conveyor belt moves parcel onto the next unit of system i.e. Tag reading unit. Tag reading unit reads the tags in the parcels using reader. The last stage of this unit is Sorting Unit where Parcels get physically Separated using physical mechanism

The Sorting Mechanism is focused mainly on Radio frequency identification mechanism. This being the main component of the project plays a crucial role in sorting. EM-18 being an RFID reader is used To differentiate the parcels tags having unique identities are stored in the parcels. DC motor rotates the conveyor belt which carries the parcels in forward path. A servo motor Arm Rotates and separates out the parcels when a tag is read with specified ID Information. This separates out parcels of specified tags from the tags. Arduino acts as micro controller used to interface various elements of this system

Before the process of Sorting can be operated on the parcels it is called for the tags to be read in the system using the software. The ID's from tags are stored and used in the Code as reference while performing compare process of the tags in future for sorting the parcels.

The process beings with the turning on of DC motor which rotates the conveyor belt. As soon as the circuit is switched on the motion of conveyor belt which is placed on the supporting beams begins in forward direction. I.e. direction of rotation set for motor. One side of the beam is connected to a DC motor; this beam itself rotates when motor starts operating. The parcels are placed on the track and they start moving in direction of the conveyor belt. The EM-18 reader interfaced with circuit is turned on and it stars reading the tags from the keys in the

parcels. Data from Reader is scanned and a signal is generated by reader to the controlling board about the key tags being scanned. The series of no. being the tagging number of the keys is then stored in the system temporarily and it checks whether it matches with formerly stored ID's.

The response of machine is either Arm rotating or being in initial position itself. If the ID of the key matches any one of the ID stored in System, then the Arm rotates else it stays in the same position. Since Arm is made up of a piece of board fixed on Servo motor it rotates in the angle directed for the Servo motor.

An angle of 60 degree is set in the system to rotate the arm so the parcel do not get directly block but smoothly addressed to the side of the unit in desired containers. The containers are marked with Information of the type of parcels and the its specification or where are they to be transferred to.

A. The Advantages of the system

1. Sorting mechanism is one of the biggest and lengthiest process in distribution and manufacturing centers. Making this process completely automated not only preserves time but also make use to man power efficiently.
2. Using RFID instead of Bar-code technology makes the process more error free and efficient since the bar-code technology needs the bar-code and the scanner to be aligned, any misplacement in alignment may result in parcels not being scanned.
3. System can sort continuously, independent of various environmental factors.
4. System is prone to less error as compared to manual sorting.
5. Man power used for same task is reduced and sorting becomes much more Orderly and Energy efficient.

6. Tracking of parcels is easier.

4. Summary

In this paper, an automatic parcel sorting machine using RFID is designed. Firstly, the system for acquisition and managing information is designed. And then the circuit of control and circuit of driver are shown. Finally, the mechanical structure is processed and made. With the gradual improvement of the logistics environment, the automated sorting system on RFID in the field of distribution will come in handy.

5. Conclusion

The working mechanism of RFID technology suits perfectly to sort out parcels and makes system much more human independent. Using this technology in small scale as well as large scale industries can be pivotal step in increasing efficiency.

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