Title: Design and Fabrication of Automatic Weight Sorting Machine

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ABSTRACT

Sorting of the objects is an essential operation used in various fields of day to day life for the sake of convenience. Until few years ago, sorting was mainly performed manually and was based on human judgments. Sorting system is more practical and economical method of automation. Main aim of sorting system is to save man power and improve quality and efficiency of the product. In the current scenario, most of the sorting systems employ the criteria like color, dimensions, material type etc. however, they carry their own setbacks like environment sensitivity, high cost and complexity respectively. The proposed sorting system in this paper uses weight as a sorting criterion. The fabricated machine aims at using the mechanical and the electronic components by their mutual co-ordination. Load cell arrangement has a preeminent position in the system. This sorting system presents a precise, reliable, consistent and quantitative sorting based on weight of the objects.

Keywords*: Weight, Conveyor, Load cell, Microcontroller, Sorting etc.*

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1. INTRODUCTION

Sorting is a process of arranging the items systematically. This process is required to be carried out in various fields of daily life. Nowadays there is consumers demand for quality of the product. In the food industry producing potato chips, sorting of new lot is done to ensure the quality of raw materials being used in the further process. Sorting parameters may be size, color, weight etc. Among these, weight is something that we cannot predict or calculate only by visual inspection, unlike other parameters. The proposed system can be effective in the situations where weight of the object is the design metric to sort. In the courier companies, charges are incurred depending upon the weight of the package, there is need to sort the packages on the basis of weight. The proposed model suggests advancements in the existing methods to enhance efficiency and reduce sorting time [1]. The model can reduce the monotonous work required to sort the agricultural products at the market places with added advantages like greater accuracy and elimination of human errors.

Presently, most of the systems used for sorting are based upon the principles like machine vision, image processing, fuzzy logic, density difference etc. which have several drawbacks. The machine vision technology can sort fine objects like tablets effectively but has its own drawbacks like high initial investment and software requirements [2].The image processing equipment includes sensors and high resolution cameras which have high cost. Also, the performance of such systems depends on the lighting conditions of the working environment [3]. Fuzzy logic involves complex programming which requires lot of expertise [4]. Fully mechanical systems employ density difference as the sorting parameter which gives inaccuracy and low efficiency [5]. Some electromechanical systems use proximity sensors along with pneumatic system for sorting objects [6] .The other systems based on weight demand costly and energy consuming devices like compressors and pneumatic auxiliaries [7].

The objective of the fabrication of the proposed machine is to overcome most of the above drawbacks and come up with an economical and simple system which is relatively easier to operate.

1.1 CONSTRUCTION

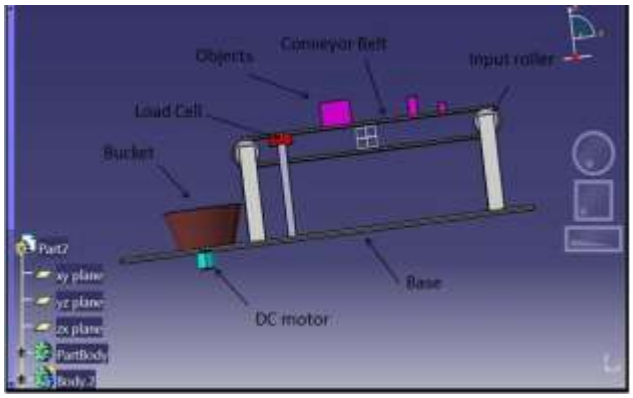

Fig-1: CAD model of the machine

The proposed model mainly consists of mechanical components like a conveyor belt, DC motors, rollers coupled with electronic components like load cell, microcontroller, circuit board and display. Out of the two DC motors, one is used to rotate the input roller and the other actuates the collector bucket. As shown in the figure, belt is mounted over the rollers and the load cell is fitted under the top layer of belt with the help of metallic strips. Electronic circuit board works together with load cell unit and is mounted on the base to guide both the motors for rotation. At the end of the conveyor is a cylindrical bucket with three compartments, each representing a certain range of weight. The Bucket is a rotary component driven by DC motor whose rotation is controlled by the microcontroller.

1.2 METHODOLOGY

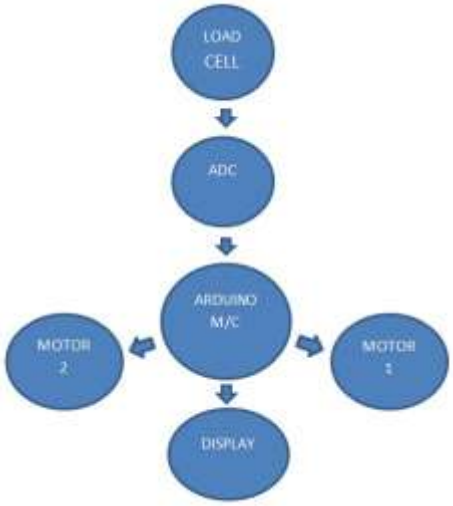

Fig-2: Block diagram of the system

When an object is placed on the conveyor belt, it is sensed by the load cell which then generates an analog output. The output voltage of load cell, which is analog, is proportional to the weight of the object. The analog

output is converted into a digital signal by an AD converter, before being sent to the arduino microcontroller. The arduino then actuates the input DC motor (motor 1) which drives the roller and ultimately the conveyor belt. The weight measured is displayed on a LCD provided on the base. Based on the weight of the object, the arduino provides a signal to the stepper motor (motor 2) which results into a rotation by the desired number of steps. This results into the object being collected in the appropriate section of the collector bucket.

2. KEY ELEMENTS

Fig-3: Fabricated system

- **Machine Bed :** It is made up of mild steel with the dimensions 760x400mm. Supports for the load cell, conveyor belt, roller are welded on the bed. Also all the electronic components are rested on the bed.MS strips for support are 250mm high. Span of the conveyor belt is 128cm

- **Conveyor Belt :** Conveyor belt is mounted on the rollers. Conveyor belt system carries the objects till the collector bucket and the object falls in the appropriate section.

- **Load Cell :** Load cell is a mechatronic component which generates an analog output proportional to weight. The load cell used in this machine has maximum capacity of 6 kg. Load cell is mounted just below the conveyor belt with the help of metal strips.

Fig-4: Load cell

Fig-5: Rollers

- **Rollers :** Rollers are made of acrylic fiber. The input roller receives the rotation from the DC motor and drives the conveyor.

3. CONCLUSION

The objective of sorting the objects according to their weights can be accomplished by the fabricated machine. Since the machine is automatic, it does not require an operator which eliminates the human errors incurred by the manual sorting. The efficiency of the machine reduces the time required for the sorting operation to a great extent.

4. FUTURE SCOPE

The machine can be modified to serve as per the requirement for various applications. For the quicker sensing of an object proximity sensors can be used. Accuracy of the machine can be further improved by the use of load cells of different load ranges and better specifications. With little changes, this machine can be used for the sorting of smaller objects like capsules or industrial parts. It can also be used for the sorting of highly valuable objects like diamonds with an increase in accuracy and precision.

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