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Counting System using Smart Sensors

S. Shridar[1], M. Priyadharshini[1]

Abstract: The objective of this paper is to design and build a Counting system using Smart Sensors for the production and manufacturing industries to reduce the loss over shortage of instruments or components and increase in accuracy of counting the instruments or components. This methodology can be implemented in any industry which uses scale counting method. The method uses industrial automation systems and smart sensors to maintain and bring the accuracy over counting. The implementation of this device helps to reduce the huge loss spent over by the companies for ages. This paper gives brief description about an assistive system designed for Industries in order to help them bring more accuracy over counting system before packaging and reduce the huge loss and saves money. This method is cost efficient and can be easily implemented.

1. INTRODUCTION

Counting System using Smart Sensors is also known as Number Counting System and it is implementing smart sensors in industries to count the mechanical components or instruments to get more accurate answers. Presently, the Scale Counting System (Fig. 1) is been used in all the industries for measuring the quantity of the instruments in the crates. This technique gives more accuracy over the number of quantity. Though, the accuracy being high, it has disadvantage when compared with the monthly statistics. It produces a shortage as one for thousand components for a single crate. This being small though, it becomes a major disadvantage at the end. So, to rectify this error, the number counting system using smart sensors can be implemented. The exact use of scale counting uses electronic machines which keeps the unit mass of few components (eg: 50 components) as fixed and measures the exact quantity of all the components in the crate.

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*Correspondence to: priya.ice@sairam.edu.in

[1]Instrumentation and control engineering,
Sri Sai Ram Engineering College, Chennai, Tamil Nadu, India

2. SCALE COUNTING

In many applications small parts, such as nuts and bolts, are counted using a scale. With scale counting the number of parts is estimated by weighing them and dividing the total weight by the (estimated) average weight of an individual part. This procedure avoids counting individual parts and can thus save time and money and improve the accuracy of counts. In this article the effect of the estimation procedure used to determine the average weight, sample size, measurement error and measurement resolution on the accuracy of the scale count are explored and quantified. General rules of thumb that suggest when scale counting is likely to be beneficial are presented. Changes in the standard implementation of scale counting are suggested.

The effectiveness of scale counting, measured in terms of the accuracy of the count, depends on the variability of the weights of the individual parts, the measurement bias, variability and resolution, the number of parts being counted, and the procedure used to estimate the average weight of individual parts. This article was motivated by an application in the automotive industry. In the application the goal is to package automotive parts in crates for shipment overseas (where the vehicles are assembled).

Fig. 1. Counting Scale in Action

The warehouse from which the shipments originate contains over 3000 different parts or components. The parts range in cost and size from engines to small fasteners. The parts are shipped in crates that are designed to contain all parts on a particular list of parts needed to build around 100 vehicles. In

this application obtaining the correct number of parts of each type in each crate is extremely important. If there are too few of any component not all the vehicles can be assembled, whereas too many of particular component leads to waste, or worse if attempts are made to use the excess components in some other assembly operation. The parts needed for a particular crate are loaded by pickers who roam the warehouse adding all the parts on their pick list. The number of pieces needed of each part varies from around 100 pieces to over 3500 pieces (e.g. some common bolts). Currently many of the parts are hand counted, but some of the smaller and cheaper parts are counted using scales. Specific aspects of this example will be explored in more detail in this article.

2.1. SENSOR COUNTING SYSTEM

The proposed system uses sensor connected to a counter logic and controlled by a microcontroller to generate the count automatically. The figure 2, 3, 4 shows the circuit connections of the proposed system. For the proposed system, the required components are,

1. Microcontroller
2. Laser kit

2.2. MICROCONTROLLER

The Microcontroller we propose for the system is Adriano (Atmega328). But, there is lot of microcontrollers available in the market survey better than Adriano. (Fig. 2)

Fig. 2: Microcontroller

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs.

2.3. LASER KIT

The proposed system requires a DIY LASER Kit for the counting system. (Fig. 3) The laser kit is used to generate the count when any metal or component or instrument cuts the laser light. When it cuts, as programmed by the microcontroller, it automatically generates as numbers on a Bi- Directional Counter (Fig. 4).Hence, for every single cut, we can notice the count automatically changing over the counter.

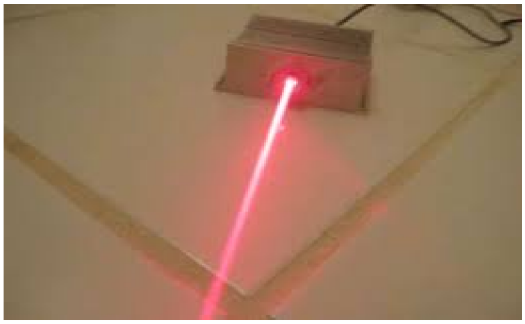

Fig. 3. Laser Kit

Fig. 4. Digital counter

3. METHODOLOGY

The proposed technique can be implemented in Production and Manufacturing Industries only when it is at least semi automated. The technique can be implemented in industries by the the circuit diagrams (Fig. 5). The Fig. 5 shows the connection between the Microcontroller and the LDR circuit. This circuit explains the circuit connection and hence we can directly implement the real time system with this circuit itself.

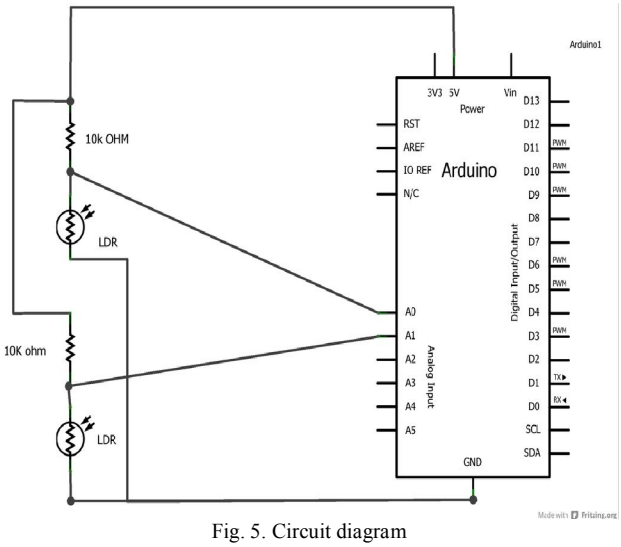

Fig. 5. Circuit diagram

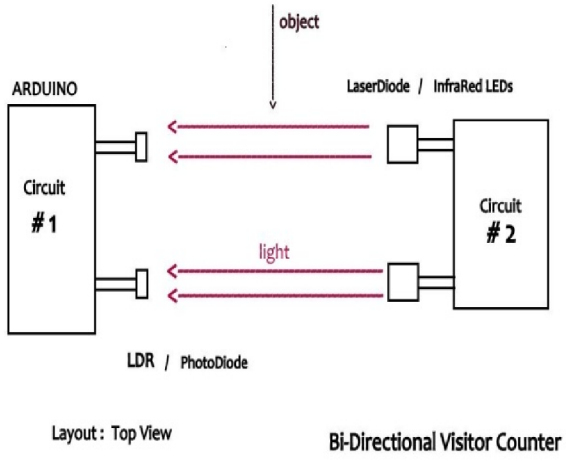

Fig. 6. Connectivity between microcontroller and LDR

The Fig. 6 represents the connectivity between the microcontroller and LDR circuit. When the component cuts the light emitted by the diode, the microcontroller as programmed (Figure 7), will initiate a count to the counter circuit.

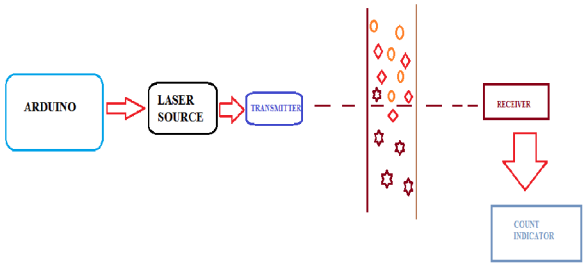

Fig. 7. Block diagram

The block diagram explains the clear process of the proposed system here arduino controlles the lazer source ,the lazer used here is less intensity lazer,the transmitter and receiver circuit .The receiver recevies the lazer signal when the signal to the receiver is interupted the there by indication the object has crossed the path hence indicatting the count .

CODING

```
int pirPin = 2; //digital 2
int counter = 0;
int state;
int laststate = HIGH;

void setup(){
Serial.begin(9600);
pinMode(pirPin, INPUT);
}

void loop(){
   int state = digitalRead(pirPin);
     if ( state != laststate) {

     //was motion detected
     counter=counter+1;
     Serial.println(counter);
    }


 laststate = state;
  delay(0);
 }
```

As programmed, the microcontroller will initiate the count when the laser is cut by the object. This can be implemented at the packaging of the components. This technique will be more efficient in finding the accurate number of components instead of measuring the weight. This technique being counting only the numbers as the components, we can improve the accuracy over counting.

4. OBSERVATIONS

4.1. Advantages

1. The Number Counting System brings more accuracy over counting.
2. Since, it does not depend on the weight, it has no reasons to worry about the weight and unit mass of the components.
3.More efficient.
4. Cost implementation is less.
5. Reduces man power over the industries.

4.2. Disadvantages

1. Can only be implemented in Automated Industries.
2. Manual working companies requires huge initial cost before implementation of the proposed system.

4.3. Budget
Based on the Industry,

1. If Automated Industry

COMPONENTS	COST
Microcontroller	Based on the required inputs.
Laser Kit	Based on the Intensity range
Bi-Directional Counter or Digital Programmable Counter	₹ 2675.00

2. If Manual or Semi- Automated Industry It requires huge money during the 1st installation of making it more Automated and then implementing the system with the above requirements.

5. CONCLUSION

A new technique of counting the mechanical parts such as nuts, bolts, fasteners, bleed screws, etc,.Using Number counting system using smart sensors bring more accuracy over the monthly statistics too. Hence, it can be implemented easily and being cost effective, this can be implemented easily.

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