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AUTOMATIC PACKAGING AND COUNTING MACHINE

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Abstract*— Industries adopt more and more automated features to increase product quality, accuracy, durability and reduce product costs and processing time. Due to automation the human effort has continued to decline since the last decade. As a result of reducing time and a number of other things, our project aims to address these issues and solve them by building an automated input and calculation machine. This project aims to automatically fund the product after it has been manufactured and count the combined products. The main purpose of this project is to address the industry to reduce human effort and time consuming. Packing speed is increased and thus has led to more productivity and business.*

Keywords — Automatic filling, automatic packing, automatic weight calculation and counting, PIC microcontroller, IR sensor, DC motor.

I. INTRODUCTION

These days, Automation in industry is becoming a trend in production and where time is undoubtedly the most important resource. It is inevitable to save the time in all places at every time. In some places such as shopping malls, department stores, automation is been introduced to the automatic delivery of the products to availing customers. A packing machine that packs items such as the snacks, drinks, cigarettes, lottery tickets, cologne, consumer products, and even gold and gems for the customers automatically. For example, automatic sales machine, ice cream vending machine, chocolate machine, water / tea / coffee machine, etc. required to identify, search, calculate and deliver product and financial management. The Automatic Teller Machine (ATM) is one of the best example of using engineering principles to reduce human time and energy. These types of sales equipment operate through the use of electronic engineering, mechanical engineering and electrical engineering, collectively called Mechatronics. The whole process of packing and counting is done with the help of using pneumatics, motors and sensors. The combined system performs the following procedures:

I. Automation and faster production using PIC microcontroller
II. Filling of machine spare parts into the bag.
III. Packing and sealing
IV. Counting and weight calculation
V. Show the calculation of integrated products.

II. OBJECTIVES

The main objectives of this project are as follows:

1. Reducing human efforts in the field of packaging, time consumption and increasing productivity limit.
2. There is a clear number of product packaged.

III. METHODOLOGY

Automatic packaging and counting machines operate according to the methodology of the Mechatronics system along with design concept with the intention of providing automation. Automation is

generally concerned with eliminating manual work using electronic processing of the mechanical work control mechanisms. It consists of the following three main units:

A. Input unit
B. Processing unit
C. Output

Input unit: The input unit of an automated packaging and counting machine contains the components needed to receive input from machine parts manufactured by the company.

Processing Unit: The processing unit contains the components needed to ensure the reception of the incoming signal. This further encodes the output unit to provide a complete package product of the machine parts after inserting the PIC controller card inside the automatic packaging and counting machine.

Output Unit: The output unit is a package of machine parts manufactured in the industry that contains the components required to deliver the product. It works on instructions from the processing unit.

The whole system being works based upon the application of electronic, mechanical and electrical systems.

a. Electronic system:

The electronic part of the system consists of a peripheral interface controller [PIC] microcontroller with integrated chips to allow processing of the system. The microcontroller is been used for total processing and the software is coded using the "MP Lab IDE 8.92" program. Each part of the entire system is been controlled by a microcontroller. It involves sensing the input machine parts from the load cell, which directs the electric motor to drive the conveyor belt and process the heating element.

B. Mechanical system:

The mechanical part of the system consists of the working mechanism of the packaging machine. Mechanical components include framework, spur gear, bearings, shaft, heating elements, etc. It delivers automatic packaging and packaging products from motor to power transmission to the counting machine. The structure and construction of the base as well as the whole machine also falls into the mechanical work. Steel casing is made using the welding and riveting process as required.

C. Electrical system:

The electrical system in an automated packaging and counting machine includes motors, sensors and power supply units. The input power supply must be forwarded to provide power to the microcontroller system at the required voltage of 12 volts. The electric motor must also take care of the power supply and this is supplied using an external battery. Select the type of electric motor required to send the packaged products out of the machine.

IV. DESIGN OF AUTOMATIC PACKAGING AND COUNTING MACHINE

The automated packaging and counting machine proposed in this paper is been made up of the following parts list:

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MECHANICAL COMPONENTS:

1. DC motor
2. Pneumatic cylinder
3. Spur gear
4. Ball bearings
5. Conveyor belt

ELECTRICAL COMPONENTS:

1. Photo microcontroller
2. Battery
3. Package heating element
4. Load Cell
5. Transformer
6. IR sensor.

MECHANICAL COMPONENTS:

DC motor

In any electric motor, operation is based on the normal electromagnetism. The current-carrying conductor is used to generate a magnetic field; When this conductor is then placed in an external magnetic field, it experiences a force that is proportional to the current in the current – carried conductor and the strength of the external magnetic field been induced. Because you were so good at playing with magnets as when you were a child, opposites (north and south) attract polarity, while polarities (north and north, south and south) repels at each other. The internal configuration of the DC motor is been designed to capture magnetic interactions.

Fig. 1. DC motor

Pneumatic cylinder:

A single acting pneumatic cylinder is an linear actuator and also detects the working stroke by filling the cylinder with an compressed air. The return stroke is usually completed by spring. The cylinder has an connection port that can be used to fill the cylinder.

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Fig. 2. Pneumatic cylinder

Spur Gear:

Spur gears are the simplest types of gears. They consist of a cylinder or disc in which the teeth are been projected radially. Also the teeth are not straight but generally specialized to achieve a consistent drive ratio. The edge of each tooth is been straight and are parallel to the axis of rotation. Spare gears excel at moderate speeds but make noise at high speeds.

Fig. 3. 55 Teeth spur gear

Ball bearing

Ball bearing is a type of rolling element bearing that uses balls to maintain separation between bearing races. This is achieved by using at least two races to round the balls and transmit the load through the balls at all time. As one of the bearing races it also causes the balls to rotate. Because the balls are been rolling, they have a very low frictional ability as if two flat surfaces slip against each other.

Fig. 4. Ball bearing

Conveyor belt

Conveyor belt is a component of industrial equipment used to transport the materials or goods. The system uses a plastic belt, on which the object can be placed. The belt then moves along the slanted track, which facilitates the transport of goods. Plastic belt conveyors have pieces of plastic that allow them to bend, making the track more versatile and capable of moving in different directions as needed.

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Fig 5. Conveyor Belt

ELECTRICAL COMPONENTS:

Microcontroller

The PIC16F877A CMOS flash-based 8-bit microcontroller is compatible with PIC16C5X, PIC12CXXX and PIC16C7X devices. The
PIC16F877 has 200 ns of instruction execution, 256 of EEPROM data memory, are self-programming, one ICD, 2 of comparators, 8 channels each of 10-bit analog-to-digital (A / D) converter, 2 capture / comparison / PWM functions. The synchronous serial port which can be configured as an 3-wire serial peripheral interface or a 2-wire integrated circuit bus and also as USART.

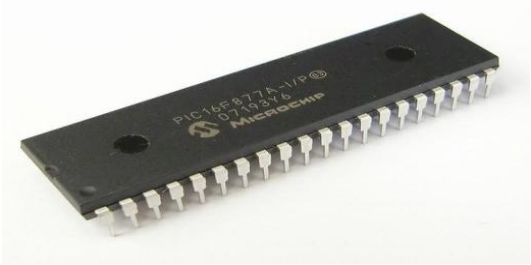

Fig. 6. PIC Microcontroller

Battery

The battery is a self-contained, chemical energy pack in which that produces limited electrical power where there is needed. The basic power unit inside the battery is called as the cell and consists of three main bits. There are two electrodes and a chemical called as electrolyte is present between them. When you connect the two electrodes of the battery to the circuit, the electrolyte starts to make a noise. Gradually, the chemicals in it are converted into the other substances. Ions are formed from the materials in the electrode of battery. This process continues until the electrolyte is completely replaced. At that point of view, the ions stop moving through the electrolyte, the electrons flow through the circuit and then flatten the battery.

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Fig. 6. PIC Microcontroller

Packaged Heating element

The heating element converts electricity into form of heat through a resistive or joule heating process. The current flowing through the element that encounters resistance, resulting in the element being heated. The constant flow of the coil makes the heating constant to close the filled material. Sealing machines are widely used in the chemical, medical, and as well as pharmaceutical industries. Sealing machines are used to process food, beverages, cosmetics, electronics and semiconductors. Some suppliers of branding equipment offer related packaging equipment.

Fig. 7. Packaged Sealing Element

Load cell

A 10 kg 5V strain gauge load cell is used here. The load cell is a power transducer. It converts an energy into an electrical signal such as tension, compression, pressure or torque, which can be measured and standardized. As soon as energy is applied to the load cell the electrical signal are being changed proportionally. The most common types of load cells used are strain gauges, pneumatic and hydraulic, pneumatic.

Fig 8. Strain gauge load cell

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Transformer

Step down transformers are used in our project. A transformer whose output (secondary) voltage is less than its input (primary) voltage is called a step-down transformer. The number of turns on the primary of the transformer is greater than the secondary, i.e. T2 <T1 of the transformer. The step-down transformer is designed with two or more coil wounds on the iron core of the transformer. It works on the principle of magnetic induction between coils acting. The voltage applied to the primary of the coil magnetizes the iron core that triggers the secondary winding of the transformer.

Fig. 9. Step-down transformer

IR sensor

The 5V IR sensor is used here. The IR sensor can measure the temperature of an object and detect movement. Usually, in the infrared spectrum, all substances emit a certain type of radiation. These types of radiation are invisible to our eyes, but the infrared sensor can detect these rays. Active IR sensors have two components: a light emitting diode (LED) and a receiver.

Fig 10. IR Sensor

V. WORKING

Automated packaging and counting machine work is mainly based on conveyor belt, load cell and PIC controller.

Packaging

The machine has a hopper used to store materials. The system consists of a load cell, when any object is placed on top of the load cell attached to the hopper, the platform attaches the top plate to the bottom. A pneumatic cylinder is placed under the hopper for its opening and closing. This creates stress on the load cell. The pressure is directly proportional to the weight which is converted into a digital signal with the help of a microcontroller. Input is given with the help of a keypad and the input value is displayed on the LCD display. Now according to the input given by the load cell, the hopper opens when a bag is placed at

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the beginning end underneath the hopper and a limited amount falls into the bag because of the weight given by the load cell.

Sealing and counting

The bag when it reaches near the heating element it operates and seals the bag with material inputted into it. Now the materials are been packaged. The last step, counting of packaged products is done using an IR sensor placed at the end. The count will be displaced in the LCD display.

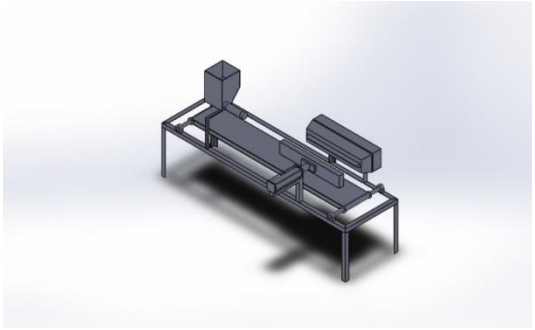

Fig 10. Proposed Outcome

VI. BENEFITS

The benefits of this automatic packaging and counting machine :

1. This machine has easy access to package products as it displays the number of packaged products.
2. Automated systems are accurate and consistent because they have precise, authentic settings and help improve the quality of packaged products.
3. It reduces human effort.
4. Helps the industry to produce products and trade faster.
5. Helps reduce time consumption..

VII. APPLICATION

- This machine can be used in all types of industries such as food factories, pharmaceutical factories for pharmaceutical packaging, cosmetics industries.
- This machine can be used in large and small scale industries that require automation.

VIII. CONCLUSION

Automatic packaging and counting machines is been manufactured that can handle weight, packaging and counting with maximum efficiency. The operation of this automatic machine is being so simpler and the probability of occurrence of errors is almost very low. Minimal time was taken in the form of automation along with the human effort required for the packaging process is reduced much behind. The whole process is been completed in just 3 steps. First, the input is calculated using a load cell, and then shipped to the bag, and then sealed. The final step is counting being calculated. The only thing to do after the process is to collect the input machine parts which are being coming out as the packaged product.

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