

AUTOMATIC PACKING CONTROL MACHINE

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Abstract:

This final year project prototype with the use of Raspberry Pi in automation industry for packaging process. Electrical DC motors used as output actuators for the system to move the conveyor belts after get the orders from the Raspberry Pi board. Manufacturing of the products is very high, especially in urban areas. This means a good business opportunity for small and medium enterprises. Those enterprises, therefore, require an automatic and affordable device that can automatically pack the products to save the time while manufacturing in large scale.

The fast advancement in technology is making whole industrial procedures automated. By the automation in the system it becomes easy to fill various materials within less time period as manual process is very much time consuming and can be inaccurate up to a level. The packing procedure that has been devised, consists of two major components. The first is a geometric packing technique that is based on morphological image processing operations. This is used in conjunction with prolong based heuristic packing procedure. Some of the factors considered at the heuristic level include shape ordering and shape orientation, both of which must be carried out prior to the implementation of the geometric packer. The heuristic procedures deal with problem constraints that are specific to a given application.

The machine design is based on simple mechanisms and it can be installed easily. The speed of packing is increased thus resulting in more production and business. This process will reduce the number of paid workers and thus increases the efficiency of packing the products

Keywords:

Conveyor belt, Industrial Packing, Raspberry pi, Computer vision, sensors, relay, Arduino Uno, Counter, Polythin cover, Hopper, Heating element.

Introduction:

In most of the small scale industries, the material packing is done by manually. This process takes more time and large human labors .There are number of packing machines are available in market. The cost of those machines is very high. Now the project has mainly concentrated on this difficulty, and hence a suitable electronic control unit has been designed such that the material can be packing in proper condition .The fabrication part of it has been considered with almost case for its simplicity and economy, such that this can be accommodated as one of the essential tools on industrial applications. This is an era of

automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Degrees of automation are of two types

- Full automation.
- Semi automation

In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

Need For Automation:

Automation can be achieved through electronics, thermal, computers, hydraulics, pneumatics, robotics, etc., of these sources, thermal form an attractive medium for low cost automation. The main advantages of all thermal (Hot air production) systems are economy and simplicity. Automation plays an important role in mass production. For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa. The moving conveyor is used to laminate the work piece automatically.

Background survey:

The manual packing process has many short comings as it will require more time to pack the packets. This problem faced by small industries so to overcome this problem they have developed this bottle packing machine. Their project is meant for small industries. It aims to eliminate problem faced by small scale bottle packing system. The entire packaging process is done with the help of electro pneumatics and motors. The control for the hardware is to be process by the programmable logic controller via the computer. The whole system executes the following processes:

- Automation using the controller
- Filling of material into the bag
- Packaging
- Sealing

Our objective is to pass the packing process from a manually operated Single Station Manned Cell to a semi-automated Single Station Manned Cell or to a Single Station Automated Cell. It means the task of operator passes from do manually the operation to supervise the process.

We are using IR sensors, UNO Arduino circuit and Raspberry Pi circuitry. As the packets is fed from the rack to the conveyor belt the conveyor belt carries the bottle forward till the packet got sense by the IR sensor, when the packet is sense by the IR sensor the conveyor stops and the bottle is fed into the box through Conveyor, And further the box is packed by the mechanism of applying the tape of the box flap.

	Hours	No. of bottles	
		Manual Operation	Automatic operation
	1 st	1200	1800
	2 nd	1200	1800
	3 rd	1150	1800
	4 th	1150	1800
	5 th	1100	1800
	6 th	1000	1800
	7 th	800	1800
	8 th	700	1800
	9 th		1800
	10 th		1800
total	10Hrs	8300	14400

Figure 1: Efficiency of Automatic v/s Manual Packing

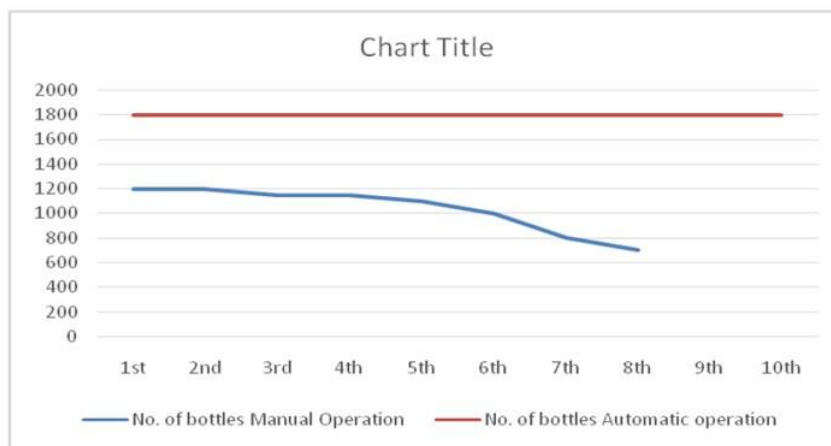


Figure 2: Graphical Representation

Product Time	28 rpm		60 rpm
	Manual Machine	Automatic Machine	Automatic Machine
One hour	17 box	24 box	51 box
One day (8 hours)	137 box	192 box	408
One week (6 working days)	822	1152	2448

Figure 3: Efficiency of Manual and Automatic machine based on RPM

Motor Speed: 28rpm the vertical line indicates the number of boxes sorted in the shelves vs horizontal lines which indicate day hours. It is clearly that the automatic control is about 141 % of manual control. Motor Speed: 60 rpm the speed of the motor for horizontal and vertical belt increased twice, here, the number of boxes that filled in one hour was increase which met the project goals for increase products and decrease time for automation systems.

As we are developing a machine which can pack the polythene cover one by one at a time, so in future for improving the packing time we can optimize the system to do multiple covers at the same time or we can pack the materials of any size. Now we are considering respective the prototype for small grain like materials (rava, powder) only. Also we can aesthetically make it more robust.

Objectives:

Design and Implementation of an affordable and efficient, packing control machine for industrial application.

- To construct Automatic Hopper Filling unit using Arduino and Sensors.
- To work on software related to overall functional units of the machine.
- To design and construct stand and heating element
- To assemble the project and work on hardware and software improvements.

Block diagram:

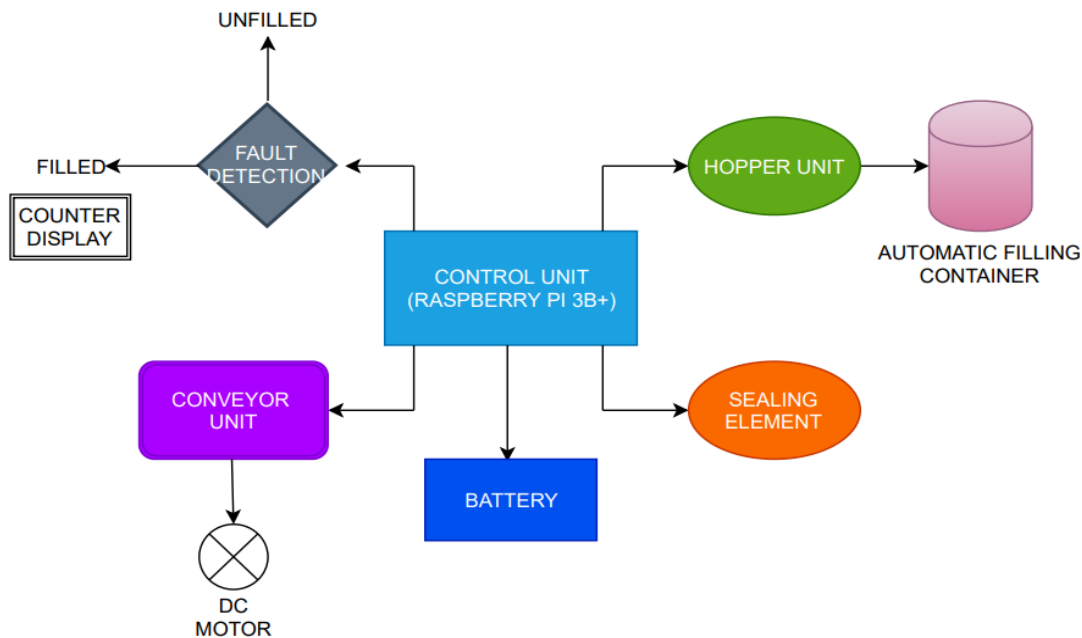


Figure 4: Block Diagram of Automatic Packing Control Machine

Working:

The automatic packaging is performed by the coordinating design of the above mentioned components. The hopper unit is constructed for storing the commodities and for filling the packages. The conveyor unit contains two frames for supporting the belt which is aligned horizontally and wrapped around two rollers for frictionless movement. The rolling of the conveyor belt is done by a DC motor attached to the roller shaft.

IR sensor is used to detect the packing cover and automatic stop the conveyor and open/close door will activate to fill the materials to the cover. After required material is filled then conveyor moves to next section. One more IR sensor is used to stop the cover and sealing is done by heater with linear DC motor.

The raspberry pi 3+B controls and coordinates the functions of IR sensors, DC motors and Hopper Unit. A heating element consist of a sealing setup of a wire and a linear DC

motor. To verify the proper filling of packages digital image processing is used, it includes fault detection in the package filling process.

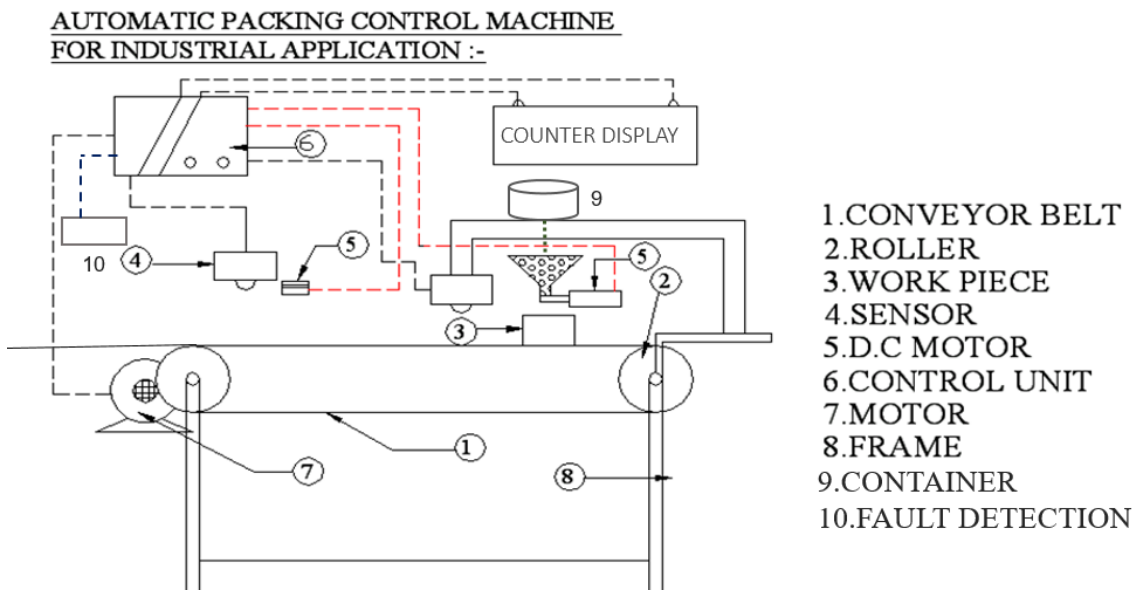


Figure 5: Working of Packing Control Machine

Methodology:

Automatic filling the hopper and counter display

Once the system is powered ON, Arduino keeps monitoring for any object near the Ultrasonic Sensor. If the Ultrasonic Sensor detects any object. Arduino calculates its distance and if it less than a certain predefined value, Arduino will activate the Servo Motor and with the support of the extended arm, it will lift the lid open. For Counting, E80-D18NK IR Proximity sensor continuously monitor for object near the eye piece, when object is detected the counter is incremented for every object

Fault detection using opencv

Web Cam captures the real time image, read the image using openCV, perform some Image processing technique and then calculate the aspect ratio for the final improvised image.

- Aspect Ratio < 1 = FILLED
- Aspect Ratio > 1 = UNFILLED

Main Conveyor unit consist of conveyor belt, two Rollers, parallel shaft, spur gear arrangement with ball bearings.

There are two Infrared sensors fixed on the stand frame with three dc motors and corresponding relay units R1(Conveyor belt control), R2(Hopper opening), R3(Heater movement).,The operation of packing is started when raspberry board receives signal from the IR sensors

At normal condition

IR transmitter sensor is transmitting the IR rays using 555 IC Timer, These rays are received by IR receiver sensor. So time relay is OFF and conveyor runs continuously

At obstacle condition

At Obstacle Condition the resistance across transmitter and receiver is HIGH due to non-conducting of IR waves so relay becomes ON and signals are given to controlling unit. When there is an obstacle in IR sensor 1 and these signals act as interrupt signal to Raspberry Pi ,In that moment time Relay R1 is OFF and Relay R2 becomes ON for 2 seconds and once again ON Relay R1 for movement. When there is an obstacle in IR sensor 2 connected to Heater element, these signals act as interrupt signal to Raspberry Pi ,In that moment time Relay R1 is OFF and Relay R3 becomes ON for 1 seconds and once again ON Relay R1. The above procedure is repeated once again for other work piece.

Results and conclusions

This project serves as control application. Raspberry Pi is used as a Control Unit. By integrating all the components, methodologies, techniques mentioned above we can build a prototype of Automatic Packing Control Machine. A heating element consist of a sealing setup of a wire and a linear DC motor. To verify the proper filling of packages digital image processing is used, it includes fault detection in the package filling process.

Our team is set out to design and manufacture a prototype of the automated packaging machine. The efficiency is comprised of cost, speed, reliability and size. The essential matrix of our project would be precision .We have been trying the best of our capacity to improve it. From the literature papers we have got some valuable information about the conveyor belt movement which we are implementing. We have implemented the horizontal movement for the polythene cover to move forward. Rather than the implementing vertical movement for taking out the filled box we place a container in which the packed cover will be taken automatically from the horizontal belt. However, every technology including the automation field consists of tools and techniques. The key point is how the designer, builders and the users of the tools and Techniques understand and apply them. Technology is no doubt important but success depends on the Way of thinking and applications without bringing in unnecessary complexity.

Scope of project:

This machine can be used in many industries some of them are written below, but scope of using this machine is not limited to this only.

- ❖ Small scale food production industries
- ❖ Automatic Weighing and packaging machine manufacturing industries
- ❖ Pharmaceutical industries
- ❖ Farmers can use it directly for packaging their agricultural products
- ❖ Can be used in medium scale soap manufacturing industries

Future scope:

- The machine has a wide application in industries. Since the machine is automating the process of weighing, packing and sealing at a very cheap cost, further research will lead to sophistication of the machine.
- This automatic weighing and packaging machine can be used widely in packaging industries, food industries, pharmaceutical, dairy products industries Further research will lead to minimization of automation cost for large scale industries also.

- Integration of artificial intelligence is recommended which could be used for more complex operations.
- By using File Transfer Protocol (FTP), the packaging and material handling will be a fully automated process without any human intervention.