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DESIGN AND SIMULATION OF LOW COST PACKAGING MACHINE IN SYNCHRONIZATION WITH ASSEMBLY LINE

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***Abstract*- In India, the industry is largely dominated by ready to eat segment, which contributed to 90 percent of total sales of packed foods in India FY2013. The industry contributes to 1.3 to 1.5 percent of India's GDP. Contribution of this industry in manufacturing GDP in FY2012 stood at 14 percent. Every company has different Strategy for its products strengthing and marketing which comes from the packaging of food materials and its content. In India the small industries are not able to established their product business and marketing because of their product value and content in comparison with other OEM in their branding value and packaging so, to increase**

their value, design of low cost packaging machine and also synchronization with their assembly line with help of virtual environment provide a greater advantage to know better about their process line and their feasibility for a long term goal. Our main focus was on how we can reduce the cost of packaging machine to benefits the small scale food packaging industry and provide a greater benefits, by designing in virtual environment and simulating with their assembly line for present and long term benefits.

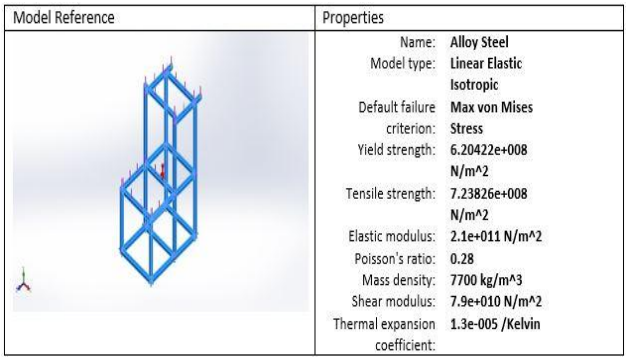
***Keywords*: virtual environment, synchronization, simulating, GDP.**

I. INTRODUCTION

The main purpose of this project was to provide the small sector food industry (MSME) with a platform that they are able to process their food item in safe packets by reducing the cost of packaging machines. In comparison with the large OEMS who have multi brand packing system show case their nutritional value of their products and additional information regarding show case and other information, which provide them a great source and huge marketing opportunity in business and customer satisfaction. We did it through designing the whole machine in virtual environment (solidworks) where every component was based on standard available mainly electronic part for automation (semi automation).Weight checking was removed by adding volumetric cup filler according to product packaging of particular industry. The design and simulation was based on the company layout factory area where we took it on virtual environment and simulated it .The synchronization of machine was done according to the controller employed in the control of machine for sealing of the packets of food items. Arduino based automation system was employed for automation.

II. DESIGN PROCESS

The design process was based on survey of different packaging machine based on type of automation and cost and working life. A details study of process and time consumption was made according to the data collected from different industry, their every process from raw materials to finish product was inspected and decision were made according to the customer specification and requirement. Also the system design for automation was done by our internal guide who is working on different automation. Finally he suggested us to idea for automating with Arduino board. Also simulation was done to analyze the different results related to load and safety. Constraints and load were given according to weight upon the whole structure. The following table represent material and load applied:



Resultant Forces

Reaction forces

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	-0.000312805	24876.3	1.52588e-005	24876.3

Fig: 1 Boundary condition and load applied

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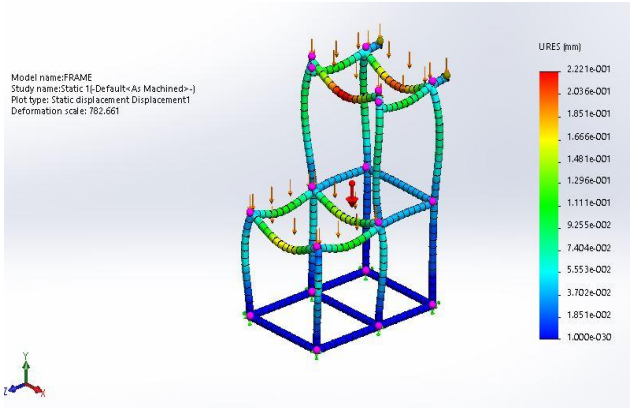

Fig: 2 Result of structural analysis (Displacement)

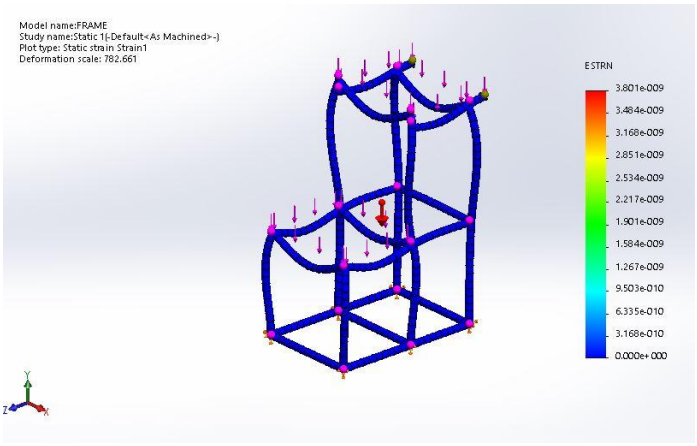

Fig: 3 Result of structural analysis (Strain)

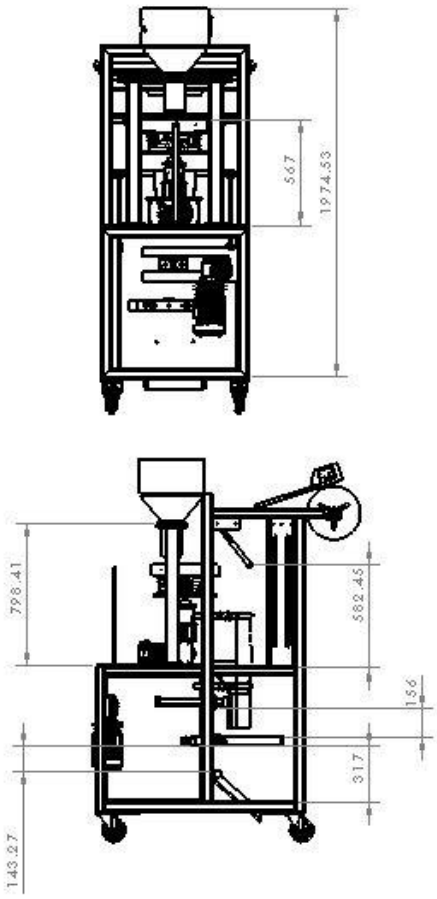

Fig: 4 Dimensional view of packaging machine

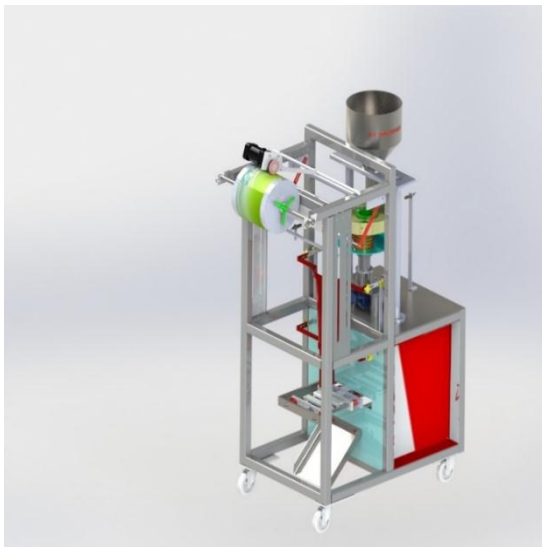

Fig 5: 3D view of Packaging Machine

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PROPSED WORK

We developed automation technique using Arduino Board and increase the speed and accuracy of the process of production. We used one load cell for measuring the weight and PIC 18F Microcontroller for displayed the weight of Job using LCD. We make PCB for PIC 18F microcontroller and interfacing for load cell and LCD. This is the initial step of the hardware and then pneumatic cylinder and indicator is connected to the microcontroller (timer) according to delay period of timer.

III. SYSTEM ARCHITECTURE

The block diagram of food packaging machine is shown

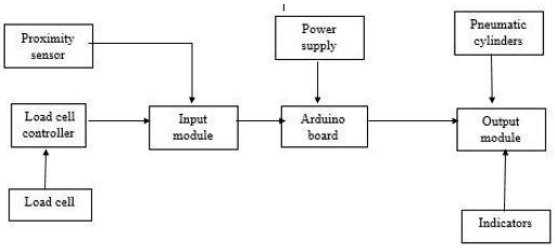

Fig: 6 Block diagram of food packaging machine

DESCRIPTION OF BLOCK DIAGRAM
PROXIMITY SENSOR:-

It is used for detecting the object which is moving on the conveyor belt. And proxy sensor send signal to the PLC to ready for object is coming. Inductive proxy sensors detect the metallic objects which is moving on the conveyor belt. The operating principle of the proximity sensor is based on a coil and high frequency oscillator that produced a field in the sensing surface. Due to presence of metal in the operating area it causes a change in the oscillation amplitude. This change in amplitude is detected by a threshold circuit, which changes the output of the proxy sensor. The operating distance of the sensor depends on the size of coil as well as the shape of target, size and material.

LOAD CELL CONTROLLER:-
PIC 18F is used for converting the load cell output into the real weight of the object using 10 bit inbuilt ADC. Load cell output is send to Load cell controller and then ADC which is inbuilt in controller is convert this output into the digital form and then controller convert it into the kg and displayed on the LCD.

Fig: 7 Circuit board of controller with solenoid and Delay timer

ARDUINO BOARD:-

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

The ATmega328 on the Uno comes preprogrammed with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

LCD DISPLAY:-
The LCD display is used for indication purpose. The weight of each job is indicated by the LCD display. +5 v DC power supply is required for 16x2 alphanumeric LCD is interfaced to the PIC18F Microcontroller.

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INDICATOR:-

Indicators is used to show whether the job is reject or accept by the pneumatic cylinder. Indicator is nothing but the one single small LED.

PNEUMATIC CYLINDER:-
Pneumatic cylinder is used to reject or accept the object depending on the signal send by the delay timer. Pneumatic cylinder is mechanical device which is use to power of compressed gas to produce a force in a reciprocating linear motion.

It is design for small scale industries to increase their market value by providing them low cost packaging machine.

VII. CONCLUSION

In industry the production speed should be high because the demand of the product is more. But when we check weight of the object manually then it will take more time for checking the weight and overall speed the production will decrease. So by using this auto weighing control system we totally overcome this problem by Arduino,PLC will handled all the operation regarding the weight, timing of the job. And operate the pneumatic cylinder according to the weight of the job.

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