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MODELLING & ANALYSIS OF AUTOMATIC POTTING SYSTEM FOR ELECTRICAL GADGET

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ABSTRACT

In this Project we will use conveyor belts for large production in small scale industries to fill large quantity of containers easily without creating any messy environment. we will use the proximity sensors to control the flow of containers on the conveyor belt. In project we will use automatic potting machine which will work on programmable logic controller. PLC operates the solenoid valve and conveyor motor. PLC control the main panel and rotation of motor and also give the feedback of rotation so solenoid valve will deliver accurate volume according to our requirement. It may able to work on variable speed as per our requirement, so no foaming problem occurs in operation. It will increase the production rate of the product significantly.

Keywords: Electronic Gadgets, Potting, Resin, Liquid, Etc

I. INTRODUCTION

Automation is very essential part of Industry whether it is big or small. Automation improves productivity of the industry. Now days even small-scale industries are going for low-cost automation or partial automation. Electronic gadgets like power supplies, LED drivers, motor drivers, and solar charge controllers are generally manufactured by SSIs. Small company involved in the manufacturing of above items. All these gadgets are very sensitive and compact. All these gadgets are potted by synthetic resins to improve the reliability and the life. Presently the process is manual, tedious, time consuming and health hazardous. After discussion with the Production In charge a detail plan will be prepare. Time study of the manual process have to perform at the premises. On the basis of rate of production and time study existing data the final time cycle has to decide. The analysis of existing automation system using PLCs have to be perform. The complete design of conveyer based automatic potting system have to do using CAD software PRO-E, 3-D model have to prepare.

II. METHODOLOGY

The methodology of this project analysis was defined these steps. The production was observed data of small-scale industries. The suitable material for the fabrication was selected and assembled. The experiment has been done for potting system for led & motor drivers. The potting should be done properly for led & motor drivers. The feedback should be provided by PLC system.

To achieve the above objectives, the following methodologies are used

- To Study the existing liquid filling mechanism.
- To Analysis of Automation Systems for new potting machine.
- Design calculation for new model
- Preparation of CAD modeling
- Analysis of CAD model.

III. MODELING AND ANALYSIS

Conveyor Belt Table A conveyor belt is the carrying medium of a belt conveyer system (often shortened to belt conveyor).

A belt conveyor system consists of two or more pulleys (Sometimes referred to as drums), with a closed loop of carrying medium the conveyer belt, that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. There are two main industrial classes of belt conveyers.

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- Those in general material handling such as those moving boxes along inside a factory and,
- Bulk material handling such as those used to transport large volume of resources and agricultural material such as grain, salt, coal, ore, sand, over burden and more.

In our project we are going to use the first type of conveyer belt. As per the design specification of our model is concerned the length of our conveyer belt should be at least 1.83 meters and its height from ground level should be 0.817 meters. We are going to use two C- channel which are each 1.83-meter-long and covered with thin steel sheet from the upper and bottom position. The basic design of table is as simple as possible for easy manufacturing of same it looks like a simple table which consist of four legs for perfect balancing of the weight of material which is moving on the belt. The material use in manufacturing of the conveyor table is mild steel. We have made use of mild steel because it had excitant strength to weight ratio and is easily available in local market.

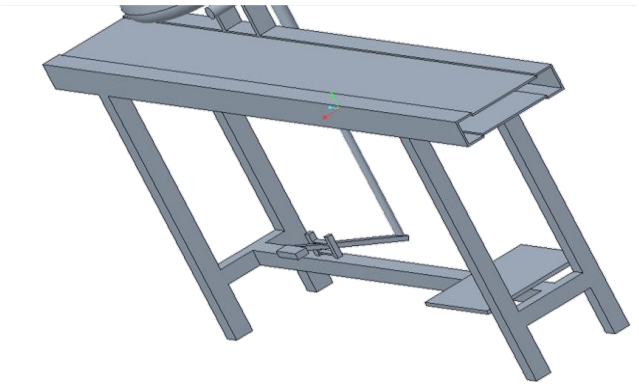

Figure 1: 3D Model of Conveyor Belt Table

Idler Idlers are an important component in any conveyer system as they are used to support the conveyer belt and the load carried on the belt. They have low friction sliding surface over which on endless conveyer belt is dragged by the driver pulley. We have used a very simple design of idler which easy to manufacture and widely used in many industries for material handling process. In this model we have used two idlers one is driver and other is driven i.e. its free to rotate as per the direction of driver.

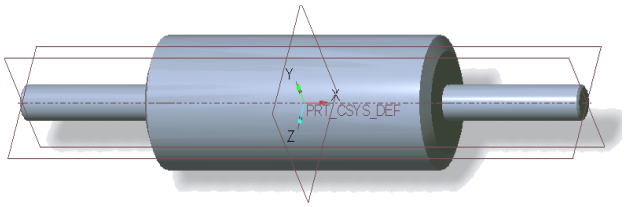

Figure 2: 3D Model of Idler

Bearing In this project we have used bearing to constrain relative motion to only desired motion, and reduce friction between moving parts. The design of the bearing may, for example, provide free rotation around a fixed axis. We have used rotary bearings to hold rotating components such as shafts or idlers within mechanical systems and to transfer axial load from the motor towards the belt conveyers.

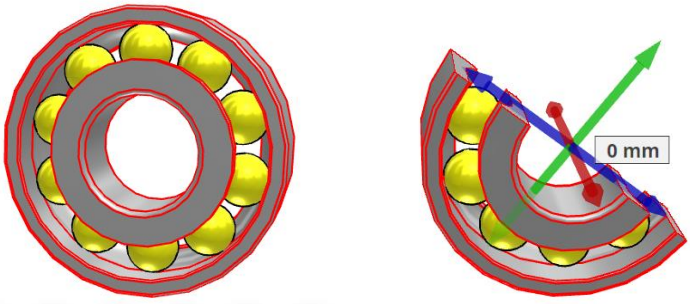

Figure 3: 3D Model of Bearing

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V-Belt Pulley A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave.

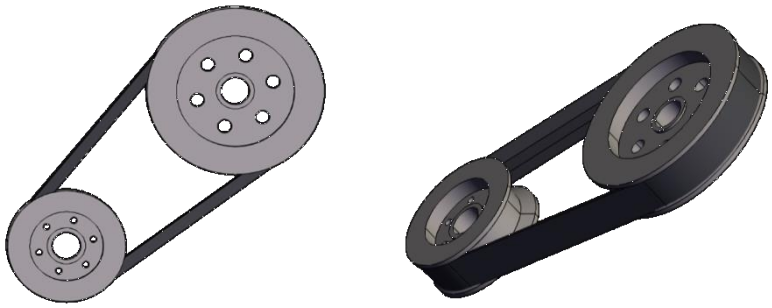

Figure 4: 3D Model of V-Belt Pulley

Conveyor Motor An electric motor is an electrical machine that converts electrical energy into mechanical energy.

Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. A conveyor motor is mechanically identical to an electric motor, but operates with a reversed flow of power, converting electrical energy into mechanical energy.

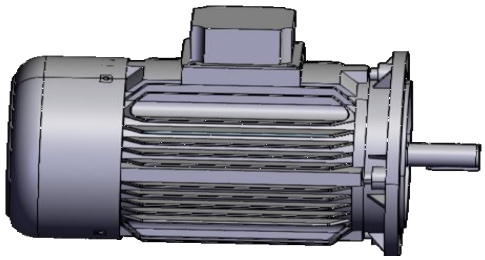

Figure 5: 3D Model Induction Motor

Hopper A hopper is a large, pyramidal, and cylindrical or cone shaped container used in industrial processes to hold particulates matter or flow- able material of any sort, like oil, paste, cream, dust, gravel, nuts, seeds etc. and can then dispense these from the bottom when needed.

In our project we are going to use a small hopper which will consist of two parts with will be joint together to form a single unit. Joining and connection of these two parts will be done with the help of self-locking mechanism.

This is the upper part of hopper its length is about 0.3 m and its basic geometry is cylindrical. There is a pouring basin on top of this hopper from which liquid resin is poured inside the hopper which will then be used for feeding it into the small boxes. The main application of this part is that by using it we can pour the viscous resin inside the hopper.

This upper hopper has a teeth housing which is used to lock the lower hopper without any permanent joint this enable its easy opening and closing function for quick cleaning of lower portion of hopper which contain highly viscous liquid resin which will settle down quickly if not cleaned in given time interval. The major force factors are associated with the upper portion of the hopper so the material used in this potion cannot be glass or ceramic therefore we have made use of mild steel sheet.

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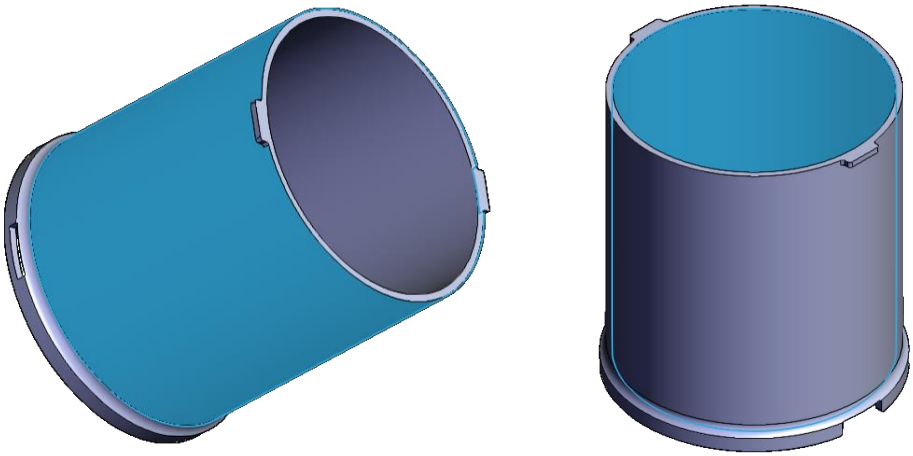

Figure 6: 3D Model of Hopper

The end part which will be connected to upper part is cylindrical in shape can is connected by using an interlocking mechanism usually known as self-locking mechanism. So that there is easy removal of these two parts from each other. The process of easy removal that to be with a great speed it must because the liquid resin which is present inside the hopper will start to settle and will block the passage and the enter assembly will have to be replaced.

So, for quick cleaning purpose the hopper is design in two part which will reduce the weight distribution of the hopper for clean and time required for the same will be very less as compared with single one-piece hopper. There is a small hole which will start to converts towards the other end of this part and at the external there is a cylindrical shape nozzle like strange which will increase the velocity of fluid. This portion is approximately about 0.17 m long and only contain liquid resin in it.

Nozzle A nozzle is a device designed to control the direction or characteristics of a fluid flow (specially to increase velocity) as it exits (or enters) an enclosed chamber or pipe.

A nozzle is often a pipe or tube of varying cross-sectional area, and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy.

Figure 7: 3D Model of Nozzle

Motor Pulley Arrangement

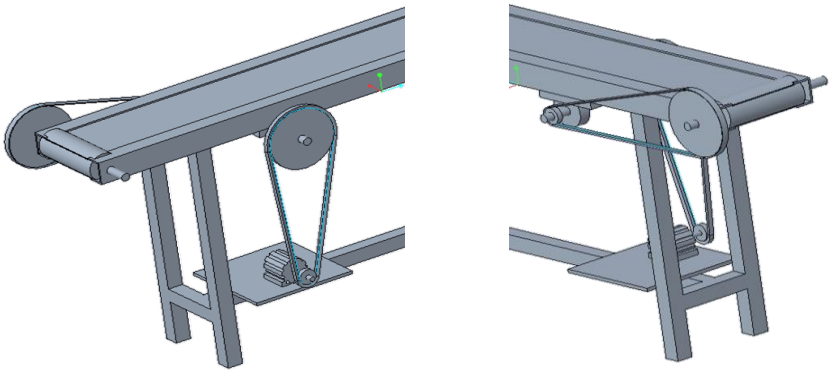

Figure 8: 3D Drawing of Motor-Pulley Arrangement

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Resin Potting Outlet System

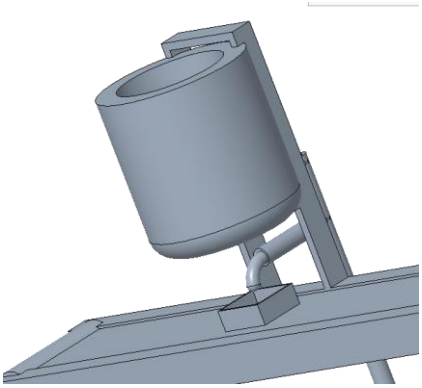

Figure 9: Resin Delivery System

Now we assemble all automation electronic element with mechanical parts in project.

This assemby consist of

- Two idlers placed at the extream potion of the conveyor belt.
- Two bearing is placed on left side of conveyor table.
- Motor and solenoid are placed one side of table legs.
- Adjuatable pin is located at the left end of conveyor which is used to move squre flange bearing for increse and decrease tension on the belt.
- Moter is located at the right side and mounted on the steel plated which is fixed on the conveyor table by nut and bolt.
- Pulleys are fixed on the moter and idler.
- Hopper is placed one side of the conveyor table.
- Nozzel is located on mid of the conveyor table.
- Crank / Pistion Cylinder and paddle arrement is placed below the hopper.

This is the entery assembly of the system. All the mechanical element are located as per the design of the system. Some electronic elements like level sensor is located beside the nozzel mounting. Infrared sensor is located in mid of the conveyor table for detecting the container when it comes in front of the nozzel.

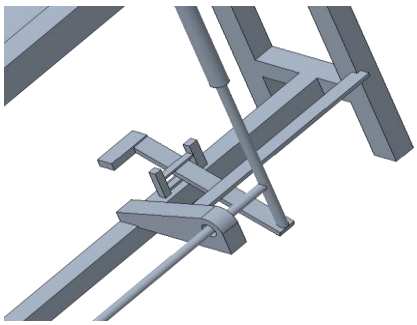

Figure 10: 3D Model Design of Paddle System

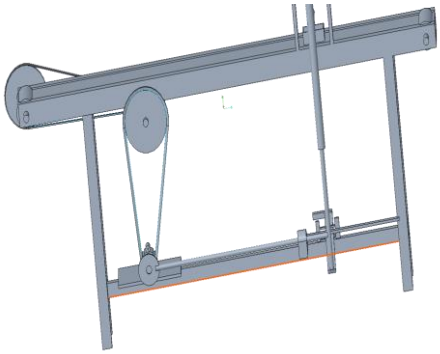

Figure 11: 3D Model Design of Conveyor Table, Induction Motor & Paddle System

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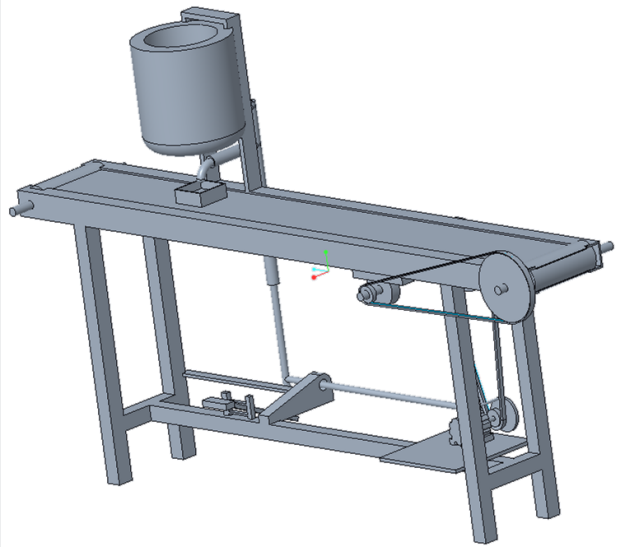

Figure 12: 3D Model Design of All System

IV. RESULTS AND DISCUSSION

In this chapter, we will study about the analysis of the result from the starting point of Journey to the endpoint of the journey.

- Many of you evaluation or invention are comes from some typical regular and unwanted problems, which is faced by everyone maybe in Industries or in our daily life.
- The problem generates a large gap towards Victory if we overcome these problems definitely new sun is arrives, which is bright and sharp and give future scope.
- We all members of our team decides that we first of all find such a problem which changes the performance of whole system. This is our sparking point or Journey point.
- Our team members Start searching about the problems from the daily day-to-day life routines from the college from the source of surroundings. In from the books From the magazines and also form teachers and other friends also.
- During the searching time our teacher guidance sir showed some videos about the industry work and labour system. At the end of the video we see a man is pouring a liquid resin into a small gadgets with its own hands.
- We and all our team members see that problem We think that it must be automatic and we get ieda for which we are searching from near about two weeks. Approximately all members of our group also says that it will be a good problem for us to invent our model which is helpful for industry as well as a for Mega project also.
- Hence, we can say that our model is also comes from typical and regular type of problem faced by most of electronic Gadget industry of small-scale industry, and we goes towards the development of model name as Design and Fabrication of automatic potting machine for electronic gadgets.
- Every industry or Society of Industry have most important social needs is that they have some large output from small input source.
- To maintain this scheme. We established / fabricated the models which increase the output with a small input source.
- Our team start Gathering some data from the books websites and available internet source. For the filling machine which are present in the markets for their components and working Behavior.
- We concluded from the websites, books that there are so many components used in the development of the model which are as given below.

1. Table
2. Conveyour Belt
3. Belt Drive
4. Motors

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5. PLC/ Aurdino
6. Nut bolts Clamps

- In above chapters all components and it's types and its advantages and disadvantages are explained in detail
- We study CREO software for Designing purpose. Where designing is the most important part of our model making without designing the model making is impossible. The design process is first of all carried on the drawing sheets with the approximate scaling and figures drawn. Then after we drawn these drawings in the Creo Software which is accurate and gives direct visualization. The 3d effect of the Designing in CREO software provides a realistic look.
- The calculation parts is the spinal cord of our model making in which we study the formulas from the various books that are study from the first year to the final year to get the formuls like Power calculation, Velocity, Acceleration ,Displacements ...etc
- The automation process is mainly done by the PLC programming in the industries so that we study the automation process with the help of PLC programming in details with the help of the electrical engineering sources.
- We practice so many times PLC programming and Audino. For development of animation of plc programing. After studying and practicing the PLC programming we make some animation related to our Project.
- At the end we developed animation of PLC programing and done some trials on that animation and it words properly as we wishes .
- All the process and trials give a good and positive response for which we are waiting and says that it is ready to use. We develop a model which works on this small investment of price and use maximum output from the point of start.
- This short points about the energies of the defaults are as follows.

1. We made the solution of the problem
2. We decrease the heavy involvement of manpower.
3. We increase the product quality and standard.
4. We increase the safety.
5. We reduce the cost.
6. We increase the productivity level of the company.

V. CONCLUSION

All the main points of the research work are written in this section. Ensure that abstract and conclusion should not same. Graph and tables should not use in conclusion.

The project on design and fabrication of automation systems for potting of electronic gadgets for small scale industry has been completed and the results have been found encouraging. The sponsor gave few suggestions as per their needs. The modifications will be done at their end.

After investigating the entire project work following conclusions have been derived.

- The journey from the identification of problem to the solution of the problem with the incense Creative work strictly followed to Industrial rules and regulation. We invented the model which gives us power to give a conclusion point.
- In large-scale Industry, we found that there is every process is of mostly automated type which gives a source of high income .Because this automation a huge change in Industrial Revolution done , which is normally mixture of mechanical, electrical and computerized system which are controlled and operated by certain software.
- When we look towards the small scale industry Lots of operation are takes place by the Manpower or labor which cause them a heavy loss in investment. And as well as from the accuracy of the product is not to that level. Their main aim is to do the work by the Manpower or labour, which is low investment cost as compared to the automated machines
- Our main aim is about to filling the electronic Gadget with low time and high speed with the small physical work of Labor. We study towards the aim and done the best automatic potting machine for the electronic gadget for small-scale industry and as well as for the large-scale industry.

- We used the most and appropriate design and automation technique to increase the value of model. The design of the process is done by the CERO software. Every part is design and then assemble it at the end. The automation process is also very important in our model making we used PLC programming and Aurdino programming for the development of the programming language in which so many programming and animation done by our members to the final outcomes.
- We used the most suitable materials which are of high strength and durable according to the norms and condition of the industry.
- The Table, Conveyor belts ,Belt Drive, Hopper, Electric motor and PLC sensor for further automation process these are the our main components of our models from which the model is stand or placed.
- The calculation part is done with the high factor of safety so that no risk of breakdown or accident failure during working. Because of calculation part we understand our model in very good sense. The calculation and design parts are strictly followed to the We solve all the problems regarding from septic or not to the heavy investment cost.
- Our main purpose of automatic potting machine is to make the high output generator. By increasing the product making in small duration of time to run in the race of market competiton by increasing the productivity and we done that. Our model can increase the productivity about 50 to 60 % from the initial Source.
- We solved Each and every difficulties found in our development stage. We solved From the problem to its solution, From low safety to high safety , From High human effort to low human effort, From high cost to low-cost, From lower accuracy to higher accuracy, From low productivity to High productivity.

In our project we designed automatic potting machine which will work on programmable logic controller. PLC operates the solenoid valve and conveyor motor. PLC control the main panel and rotation of motor and also give the feedback of rotation so solenoid valve will deliver accurate volume according to our requirement. It is able to work on variable speed as per our requirement, so no foaming problem occurs in operation. It will increase the production rate of the product significantly.

VI. REFERENCES

[1] D. Baladhandabany, S. Gowtham, T. Kowsikkumar, P. Gomathi "PLC Based automatic liquid filling system" Department of EEE, INFO Institute of Engineering, Coimbatore. "IJCSMC, Vol. 4, Issue. 3, March 2015, pg.684 – 692"

[2] Mahesh S. Ghule and Dr. (Mrs.) R.S.Bindu , "Design, Development & Analysis of Vacuum Chamber of Potting Machine", International Engineering Research Journal Page No 549-556.

[3] Nisarg A Solanki, Pratik G Raj, Saumil P Patel and Charmish D Rajput, "Automatic Liquid Filling Machine", International Journal of Engineering Research & Technology (IJERT) Vol. 4 Issue 05, May-2015.

[4] Bipin Mashilkar ,Praseed Kumar, Amit Chawathe , Vivek Dabhade , Vighnesh Kamath and Gayatri Patil, "AUTOMATED BOTTLE FILLING SYSTEM", International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 04, Apr-2016.

[5] Bin Hong, Hong-mei Wang, Ju Hu, Qing Liu and Jing Hou, "Development of Resin Vacuum Potting Equipment" International Conference on Applied Mechanics, Mechanical and Materials Engineering (AMMME 2016) ISBN: 978-1-60595-409-7

[6] Ameer L. Saleh, Lawahed F. Naeem and Mohammed J. Mohammed, "PLC Based Automatic Liquid Filling System for Different Sized Bottles" International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 12, Dec-2017

[7] Komal Manhas, Meenakshi Dogra, Rajinder Tiwari and Jamini Sharma, "Design and Implementation of Bottle Filling Automation System for Food Processing Industries using PLC", International Journal of Power Electronics Controllers and Converters eISSN: 2456-1614 Vol. 4: Issue 1

[8] Prof. Deepthi. D, Ananya.R. N, Bharath.K, Lekhana.S and Nikhil.D.J, "PLC Based Automatic Bottle Filling System", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE) | e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765

[9] Juliya KV, Mohammed Anas MV , Mubarak and Muhammed Hazil, "Automatic Bottle Filling System", International Journal of Innovative Research In Management, Engineering And Technology, ISSN (Online): 2456-0448, Vol. 1, Issue 4, May 2016

[10] Electric solenoid valve.com Available: https://www.electricsolenoidvalves.com/blog/how-does-a-solenoid-work/

[11] P. VIJAYKUMAR and K. ANUSHA, "Automatic Liquid Bottle Filling System by using PLC", International Journal of Scientific Engineering and Technology Research, ISSN 2319-8885 Vol.07,Issue.03, March-2018, Pages:0424-0427

[12] Ashwani Kapoor, Vivek Jangir, Jaswant Kumar, and Gaurav Tiwari, "Automated Bottle Filling System by Using PLC", International Journal of Management, Technology and Engineering, ISSN NO: 2249-7455 Volume 8, Issue V, MAY/2018

[13] Dr. R.K Bansal, Fluid Mechanics and Hydraulic Machines, 9th ed., I.I.T Delhi, 2014.