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SEMI-AUTO FILLING MACHINE

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This Report Is Submitted In Partial Fulfillment Of Requirements For
The Degree of Bachelor In Electrical Engineering (Industry Power)

Fakulti Kejuruteraan Elektrik
Kolej Universiti Teknikal Kebangsaan Malaysia

March 2005

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Date : 9 MARCH 2005

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ABSTRACT

This project is to build a small model semi-auto filling machine which is to adapting idea from the similar system with fully automatic which is used in mass production industries. Semi-automated system depends on upon the interaction of a person and machine to perform work. The person usually makes the decisions at the start of the process and the machine completes the work. It is easily done by a human, such as loading and unloading the machine. This project requires careful design and precise interaction of components. By using software ladder diagram and electric circuit diagram for semi-auto filling machine was build. Other than that, studies on PLC system software and studied on the circuit design was done. For hardware, the model for small and medium class industry was constructed. The pneumatic movement, electrical movement and mechanical movement were implemented. This project can be implemented in small industries.

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ABSTRAK

Projek ini adalah untuk membina sebuah modal conveyor jenis Semi-Auto. Mesin Semi-Auto adalah interaksi diantara seseorang individu dengan mesin yang sedang berfungsi. Dengan mesin ini, manusia hanya mengambil langkah dari segi mengfungsikan mesin tersebut (switch on) dan langkah ini menyebabkan mesin tersebut menyempurnakan proses berikutnya. Mesin ini adalah mudah untuk mengendalikan oleh manusia dalam keadaan proses ataupun tanpa proses. Komponen yang terdapat pada mesin ini mudah untuk dikendalikan. Perisian ladder diagram serta menghasilkan pemasangan elektrik (electric diagram) juga perlu di buat bagi mengendalikan mesin tersebut. Selain itu, dengan membuat projek ini, dapat menambahkan pengetahuan dalam sistem PLC serta mengaplikasikan ataupun reka sistem elektrikal. Dari segi hard ware pula, saya dapat menghasilkan sebuah modal ataupun mesin conveyor yang boleh digunakan di industri kecil.

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CHAPTER 1

SEMI-AUTO FILLING MACHINE

1.1 Introduction To The Project

There are many types of filling machines available on the world market. The Semi-Auto filling machine system is depends upon the interaction of a person and machine to perform work. The person usually makes the decisions at the start of the process, and the machine completes the work. Decisions usually determine the length of operating time, type of tools or product, number or size, and other variables that are likely to change. The person also performs tasks that are more easily done by a human, such as loading and unloading the machine, inspecting for quality control, and determining proper operating speeds.

This semiautomatic filling machine assembly is the process of completing operations by hand with aid of power equipment. The proposed project is designing a low cost model filling machine for small-scale industries. One type of filling method may fit certain applications better than others. Conversely, some filling methods are not suited for some applications at all and will result in wasted investment.

However, as a practical business decision, there are really few technologies that offer the greatest flexibility at the greatest economy. For examples Servo Positive Displacement Filler, and Level Head Overflow filler.

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1.2 Project Background

I have chosen this project by the basis of; this project can help improve our small industries. It can help beginners improve their production. The project does not need a lot of model to build it. By choosing this project I have also learned a lot of new things. For example programmable logic control (PLC). Out of these 4 years of course I have never learned PLC. But completing this project I know a lot about PLC. I have learned how to design a program, draw the ladder diagram and know how to use the components inside the KEYENCE. By doing the research about PLC I have learned what is the function and important of the PLC in industry. This project also can help other students in future. They can use this model as reference and guidance to upgrade more on the conveyer. By choosing this project, I might be able to conduct a bigger project related to conveyer and upgrade it to become a fully automatic system.

1.3 Different With Semi-Auto and Fully Auto system in Filling Machine

Automated systems perform work with little or no interaction with people once the system is placed in operation. These systems require careful sign and precise interaction of components since they must make decisions to perform the required work.

Semi automated systems depend upon the interaction of a person and machine to perform work. The person usually makes decisions at the start of the process, and machine completes the work.

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1.4 Objective

The objective of project is:

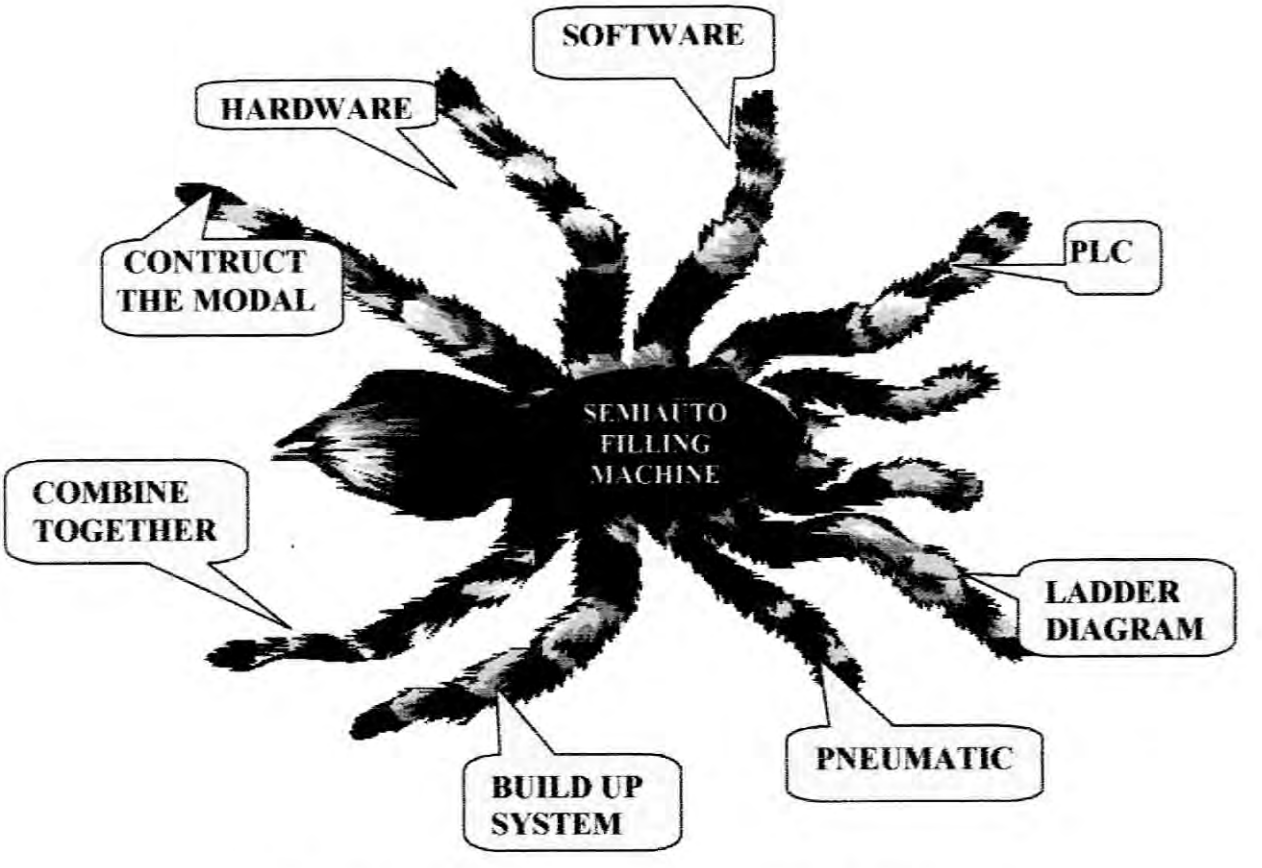

FIGURE 1.1 : Objective Of Semi-Auto Filling Machine

Ladder Diagram- Ladder circuits are primarily used to control a semi-auto filling machine process. Simple circuit that controls its operation. The ladder diagram is describing the function of semi-auto filling machine.

PLC- The programming unit of a PLC provides a way to enter data and edit and monitor programs stored in the processor unit. The programming unit communicates with the processor unit by using data communication link that transfers data in a serial or parallel fashion.

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Pneumatic- A fluid power system is one that transmits and control energy through the use of pressurized liquid. In pneumatic the power is air. Versatility and variety of pneumatic control at semi-auto filling machine.

Hardware- Construct the modal (mechanical work) or mechanical load.
Software- include with PLC programming, built ladder diagram for the system/process.

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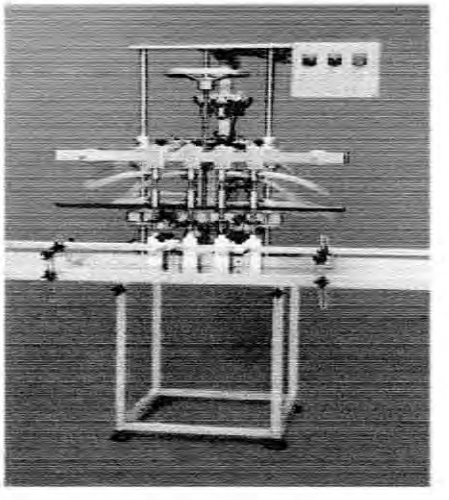
CHAPTER 2

LITERATURE REVIEW

2.1 About Filling Machine

2.1.1 Semi Automatic Overflow Filler



Picture 2.1: Semi-Automatic Overflow Filler

Application:

Liquids with low to medium viscosity and with no solid particulates exceeding. This "over flow" is the superior method for filling very foamy products.

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Examples:

Sauces, syrups, light gels and shampoos, foamy cleansers and chemicals, water and other and carbonated aqueous.

Operation:

Simple footswitch or pushbutton begins filling cycle; Fill Heads Come Down To Seal Mouth Of Container; Pump Then Runs For Period Determined By Timer. After Fill Sequence, Heads Remain Over Container Mouth For Programmed "Dwell" Time To Reduce Any Foam. Fill Heads Then Rise And Filled Bottles Are Removed. Can Be Mounted With Hand Held Capper.

Advantages:

Lower cost option for low production needs (< 40 bpm), easy to clean, easy to operate, flexible for wide range of products. 110v/air operated; can be easily installed any where.

This Machine Can Be Upgraded To

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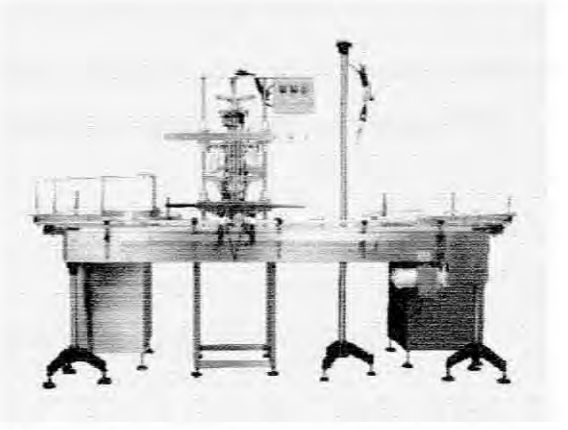
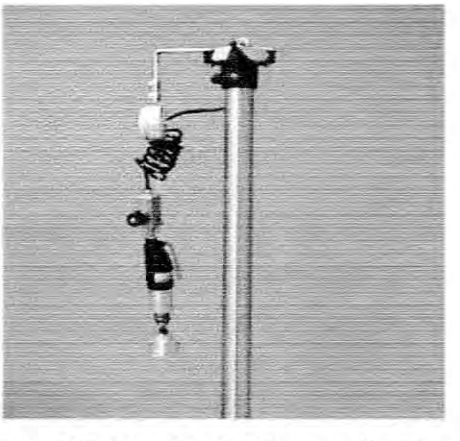
2.1.2 FULLY AUTOMATIC OPERATION



Picture 2.2 : Fully Automatic Operation

This Semi Automatic overflow filler has been upgraded to an automatic system wherein a single operator can produce well over 1000 filled and capped containers per hour. The system above includes a bottle feeder (unscrambeler), automatic indexing 10' long conveyor, hand held capper, and a bottle accumulator. If more conveyor and hand held cappers are added, production speed can increase an additional 20 containers per minute (average).

2.1.3 Hand Held Pneumatic Capper



Picture 2.3: Hand held Pneumatic Capper

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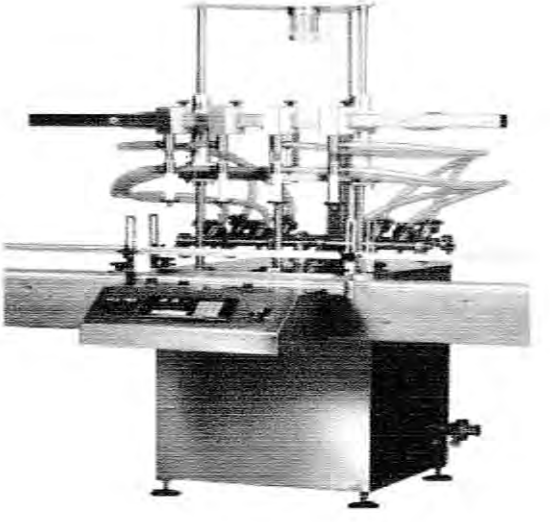
Air powered hand held capper is placed over cap and torqued on demand by operator. Torque is controlled by air regulator. Capper is mounted on spring loaded reel to take weight off the operator. Entire assembly is attached to stainless stand which can be mounted on semi automatic filler. The capping head is located directly above the bottle so that minimum movement by the operator is necessary. ***THE COMPUTORQUE CAPPER: NEW CAPPING Technology.***

2.1.4 LEVELHEAD II OVERFLOW FILLER



Picture 2.4: Level Head Overflow Filler

Application:

This type of filler is best suited for liquids with low to medium viscosity. Liquids with solid particulates not exceeding 1/16" can also be filled. Note that overflow fillers are the machine of choice in handling very foamy products at higher speeds.

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Examples:

Sauces, Syrups, Light Gels and Shampoos, Foamy Cleansers and Chemicals, Water and Other Non Carbonated Aqueous Beverages.

Advantages:

High Performance, Easy To Clean, Easy To Operate.

2.2 About MSP to Keyence KV-10 to 80

This revision is based only on the High-Speed Counter driver. It has no been fully edited to reflect usage of the Delta protocol.

Following are some miscellaneous notes that may help with the driver for this PLC.

2.2.1 What is an MSP Driver?

An MSP driver is a small ladder logic program that is added to the user program. All code is standard ladder logic. In Keyence KV-10 to 80 it requires a set of lines of logic at the beginning of the main program to setup a timed interrupt. The interrupt subroutine may be the complete driver or in some versions it may call one or two other subroutines.

The user can copy the driver into their program by opening the driver file and the target file simultaneously. The desired rungs can be highlighted and copied from the driver program. Next the user will go to the target program, position the cursor where desired and paste into the target program.

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Alternately the user could start with our driver and build their program from it.

2.2.2 Drivers

The following is a list of drivers in the MSP Driver Library for the Keyence KV-10 to 80 PLC. These drivers were prepared with Keyence's Ladder Builder for KV programming software, revision 1.02. The single channel input and single channel output drivers are available on the Driver Installation disks.

2.2.3 Different Models

All drivers for the KV-10 to 80 should work with very little revision in all models.

a) Keyence's programming language is identical in all models.
b) The memory layouts are very similar in all models. The memory for the KV10/16 is a subset of memory for the KV20/40/80. The memory for the KV20/40/80 is a subset of memory for the KV300 series.
c) The MOS-FET outputs 502 and greater on the KV-16/24/40 are much slower than the transistor outputs on other models. Scan rates may have to be slowed down when using these outputs. All transistor outputs and MOS-FET outputs 500 and 501 will allow the MSP outputs to be run at higher speeds.
d) Models with relay outputs can be used but care must be taken to conserve relay life. See the sections on outputs regarding these modules.

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2.2.4 Memory Usage

The attached table shows the memory usage for the different drivers available for Keyence KV-10 to 80 PLCs.

2.2.5 Block Diagram

The following block diagrams show the flow of execution and the data resources used by the different drivers. Note that single channel drivers use the memory in the driver logic. The multiplexed drivers use a separate block of storage register for each channel. The data in the storage block is moved into and out of the memory used by the driver logic.

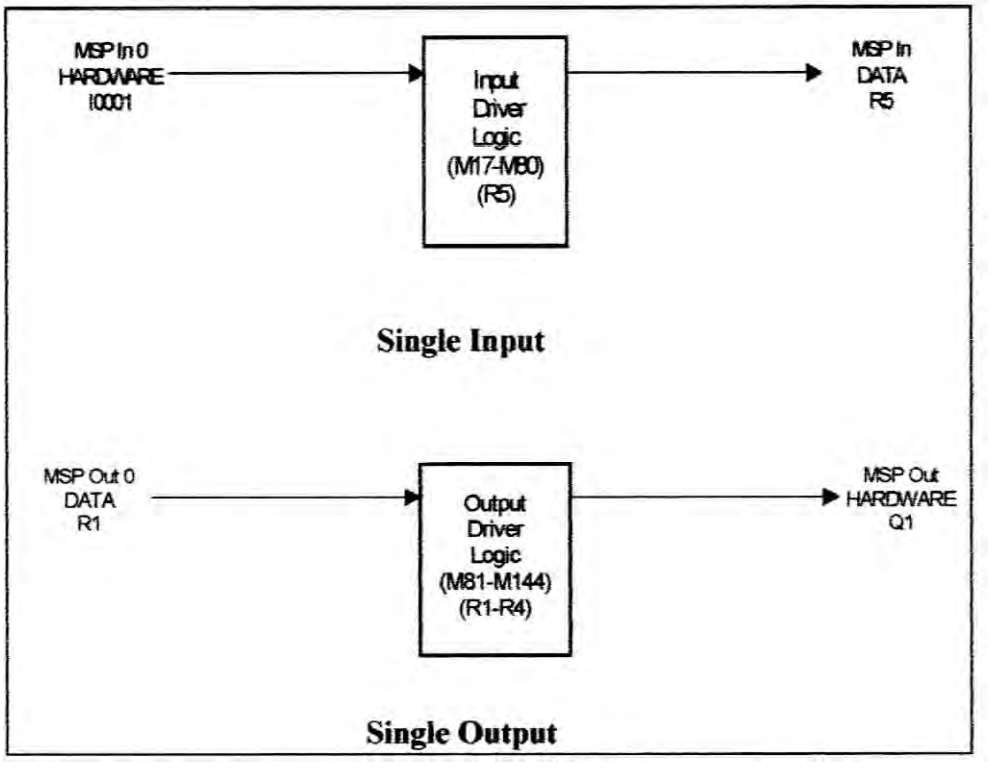

Figure 2.1: flow of execution

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