EMBEDDED CONTROLLER DESIGN FOR EVAPORATOR SYSTEM

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"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)"

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Date : …….

"I hereby declare that this report is a result of my own work except for the excerpts that have been cited clearly in the references."

Signature :……

Name : MUHAMMAD FIRDAUS ABDUL RAHIM

IC No : 851201-14-5501

Date : …….

I dedicate this to my parent, my lovely family, my dear supervisor, my friend and electrical engineering education.

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ABSTRACT

This project is to design and develop controller system for air-conditioner evaporator system. It consists of hardware and software parts. The development of controller for car air-conditioner evaporator is an improvement from original system. A new innovation of controller for car air-conditioner evaporator system is designed with same operation. The design is operated using PIC (PIC 16F877A) and it is programmed by using C-Language. This new design will assure the air-conditioner evaporator system will operate consistently.

ABSTRAK

Projek ini adalah untuk merekabentuk dan membangunkan sistem kawalan untuk *evaporator* dalam penghawa dingin kenderaan. Projek ini termasuk sistem perkakasan (hardware) dan perisian (software). Pembangunan sistem kawalan untuk *evaporator* penghawa dingin kenderaan ini adalah untuk memperbaiki sistem yang sudah sedia ada. Sebagai penyelesaian kepada sistem ini, satu enovasi sistem kawalan akan dibina dengan pengoperasian yang sama dengan sistem sedia ada. Rekaan sistem kawalan ini akan menggunakan sistem PIC (PIC 16F877A) dan diprogramkan menggunakan Bahasa C (C-Language). Rekaan ini akan memastikan sistem *evaporator* penghawa dingin kenderaan berfungsi dan beroperasi secara konsisten.

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1.0 INTRODUCTION

EMBEDDED CONTROLLER DESIGN FOR EVAPORATOR SYSTEM

1.1 INTRODUCTION OF PSM PROJECT

This project is created to design an evaporator system that control car air-conditioner automatically using microcontroller (PIC). This project is the combination of electrical, electronics and mechanical engineering field to represent the new invention which is regarding the design and development process.

This project is conducted in order to overcome the problem of the original system. The old design of air-conditioner evaporator controller needs combination of two systems to start the application of blower that is the major part in evaporator system. This new design only needs one system to allow the car air-conditioner evaporator to operate with the swing from blower part. This new design provides more advantages compared to the original system.

As for evaporator air-conditioner system, this parts of air-conditioner system can control many variables and applications that is important in order to complete the function of car air-conditioner system. It can control temperature, thermostatic, defrost pump down, defrost low ambient condition, heat, humidity, capacity system and liquid line.

This Projek Sarjana Muda (PSM) is focusing on controlling the starting point of blower. It will control the whole system of this evaporator system with the exact value of voltage. The old design of controller system is using hardwire connection compared to this new design that will be totally controlled with PIC (Peripheral Interface Circuit).

1.2 PROJECT OBJECTIVE

- To construct, design and fabricate evaporator air-conditioner system that consists hardware parts and software program.
- To learn and develop PIC (Peripheral Interface Circuit) controller to control the operation of evaporator system.
- To implant together both hardware parts and controller system that has been designed.
- To learn more on installation and troubleshooting.

1.3 PROJECT SCOPES

- Make a hardware installation that indicates wiring, soldering, testing and troubleshooting for both evaporator system and PIC controller.
- Design the controller (PIC) programming with micro-controller (PIC16F877A) using C language.
- Determine the suitable sensor to control the blower part in evaporator air-conditioner system.
- Build an interface connection between controller (PIC) and evaporator part (blower).

1.4 PROBLEM STATEMENT

Previous controller for air-conditioner system used combination of thermostat and timer system. It uses many hardwire connections and the accuracy for its operation is decrease by time. The operation will less in persistent and for further time, it will affect the consistency of air-conditioner system. As for evaporator system, with the previous controller, the controlling of its blower with the using of timer will affect the overall operation of evaporator system.

- The older design has complex hardwire system.
- The older design needs combination of thermostat and timer system.
- The older system is less in accuracy of controlling operation.
- The implementation of the older control system is fixed.

1.5 PROBLEM SOLVING

For evaporator air-conditioner system, the new controller will be design with PIC controller using micro-controller PIC16F877A with c-language. This controller will reduce the using of hardwire connections. With this controller, the persistent of its operation will maintain for long timeframe.

- The new design will reduce hardwire connection.
- The new design will increase the accuracy of controlling operation.
- The new design only needs one system to control whole operation.
- More applications can be implementing with this new design.

2.0 LITERATURE REVIEW

2.0 LITERATURE REVIEW

First step in developing a new controller for air-conditioner evaporator system is to do research regarding the evaporator system, the older design of controller system and the suitable programmable controller for future design. The knowledge, application and implementation from this whole system will evaluate the perfect controller system in completing this project. This literature review parts will provide and explain the concept of air-conditioner evaporator system and its controller.

2.1 JACKES-EVANS EVAPORATOR CONTROLLER

Jackes-Evans is the founder of Parker Engineering that is one of the global leaders in Motion and Control Technologies. Jackes-Evans has stated typical applications for evaporator controller system. This Jackes-Evans information can be found with this company website www.parker.com. Jackes-Evans stated that there are sux type of controllers for evaporators system related with solenoid valve that is The Evaporator Temperature Controller, Thermostatic Control of Two Separate Evaporators, Defrost Pump Down, Split Evaporator Humidity Control, Heat Reclaim Serial System and Heat Reclaim Parallel System.

2.1.1 The Evaporator Temperature Controller

The Evaporator Temperature Control has a solenoid valve installed in the liquid line as close to the evaporator as possible, that is in conjunction with a narrow differential thermostat. It is an excellent temperature control. By mounting the thermostat bulb in the supply or discharge air across the evaporator, the temperature swing is limited only by the differential of the thermostat. Figure 2.1 represent the evaporator temperature controller. It shows the connection between equipment and flowing of temperature swing of compressor, condenser, evaporator and thermostatic valve. The valve is installed close to evaporator.

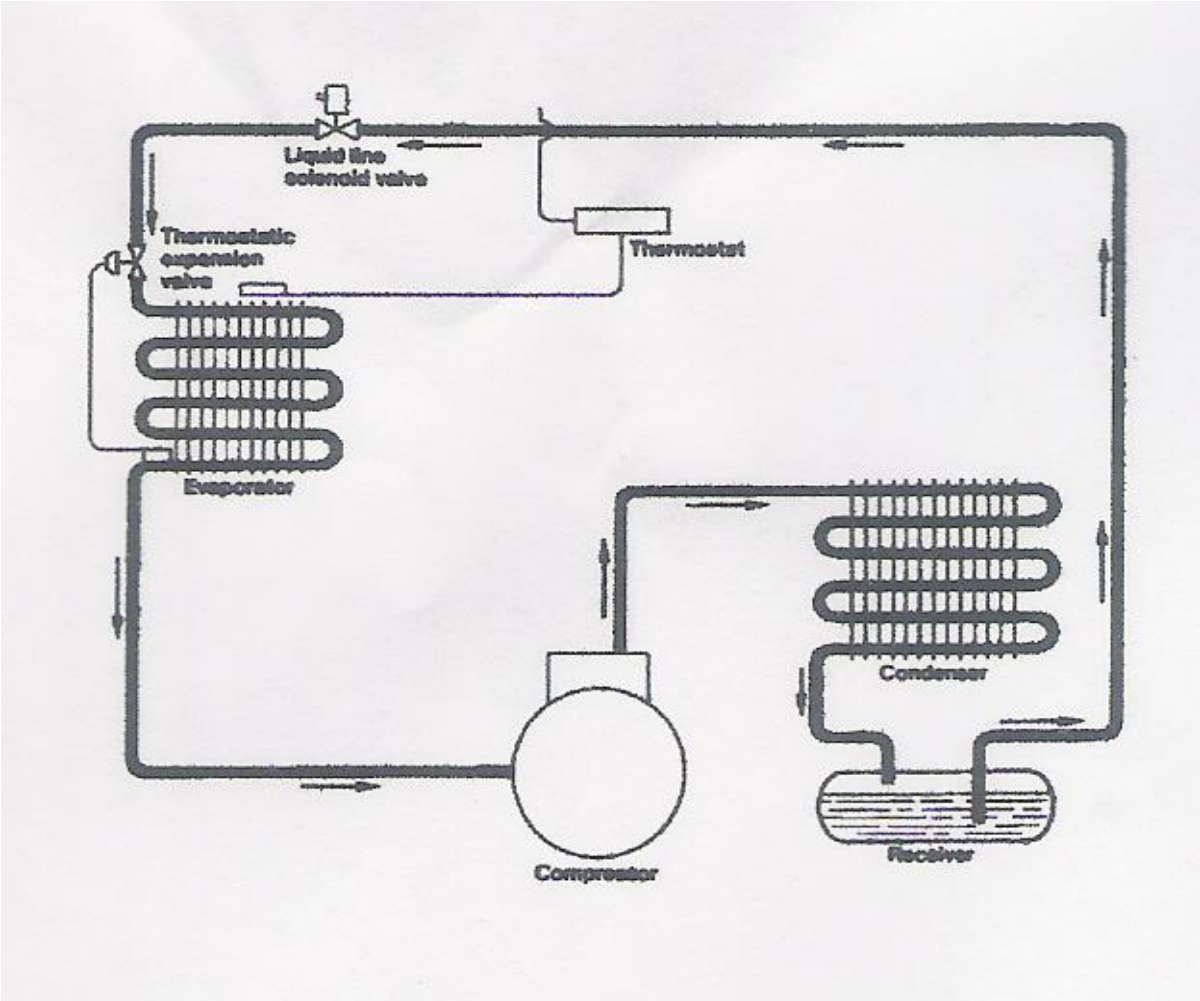

Figure 2.1: The Evaporator Temperature Controller

2.1.2 Thermostatic Control of Two Separate Evaporators

The Thermostatic Control of Two Separate Evaporators is a type of temperature that can be used on a single or multiple evaporator system and is particularly useful on multiplexed systems with evaporators at different temperatures. Figure 2.2 represent the construction of two separate evaporators with thermostatic control. The flowing of liquid start with compressor through condenser and then it separate to both evaporators.

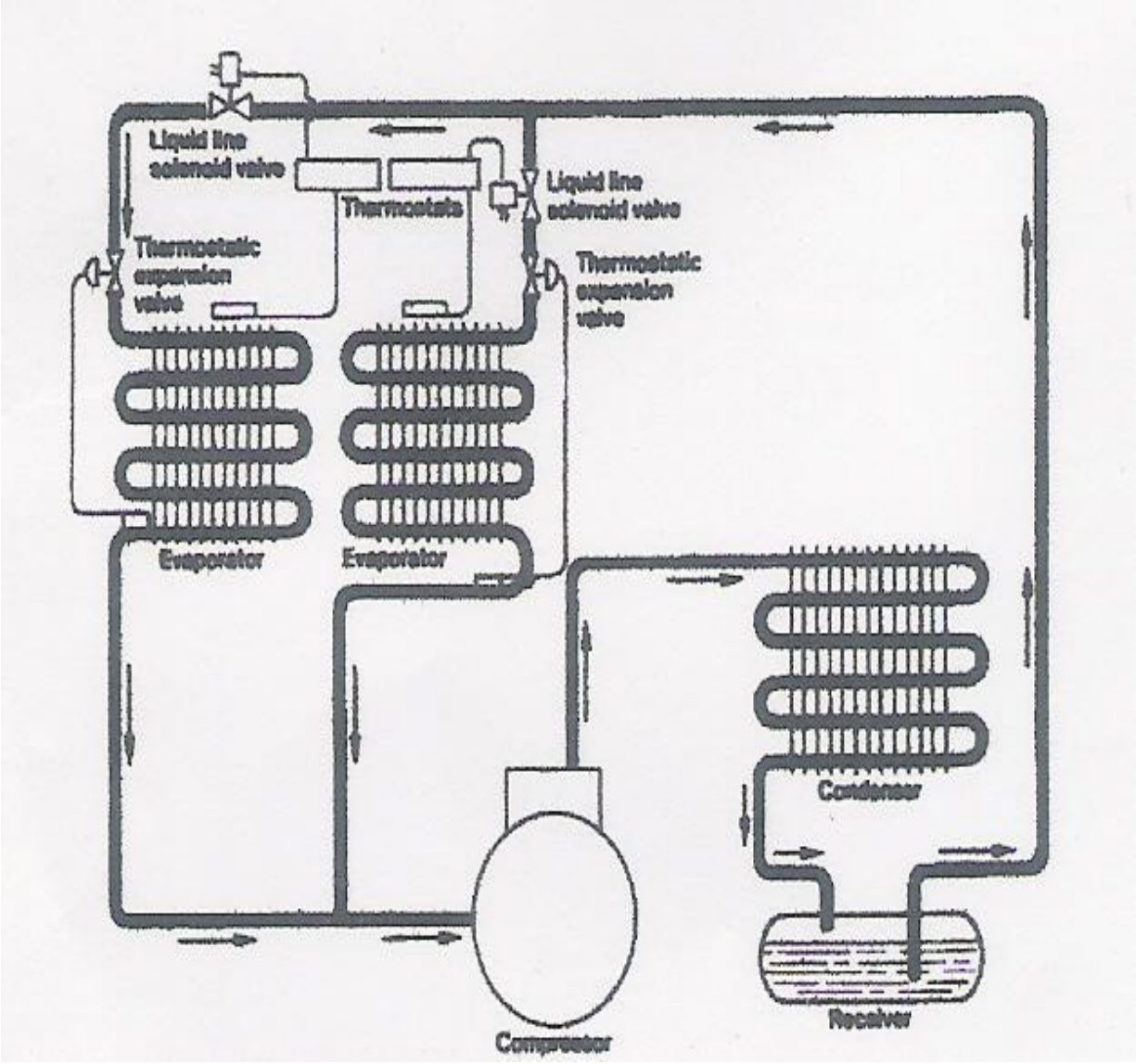

Figure 2.2: Thermostatic Control of Two Separate Evaporators

2.1.3 Defrost Pump Down

The Defrost Pump Down is a situation where the condensing unit is installed in a low ambient such as on a rooftop. The evaporator is operating at a temperature above the ambient and will detract the pump down solenoid valve. This allows the pressure control to be asset at a cut out of 1 to 2 psi and the cut in to be set at a pressure below the pressure corresponding to the ambient temperature. This will insure the condensing unit will start after cooling down during defrost. When a system has a defrost pump down solenoid valve, a thermostat should be used in series with the time clock defrost to control the temperature. An alternative to the thermostat would be an evaporator pressure regulator.

Figure 2.3 represent the connection of defrost pump down that consists of three main part of compressor, condenser and evaporator. The evaporator will detract the pump down solenoid valve.

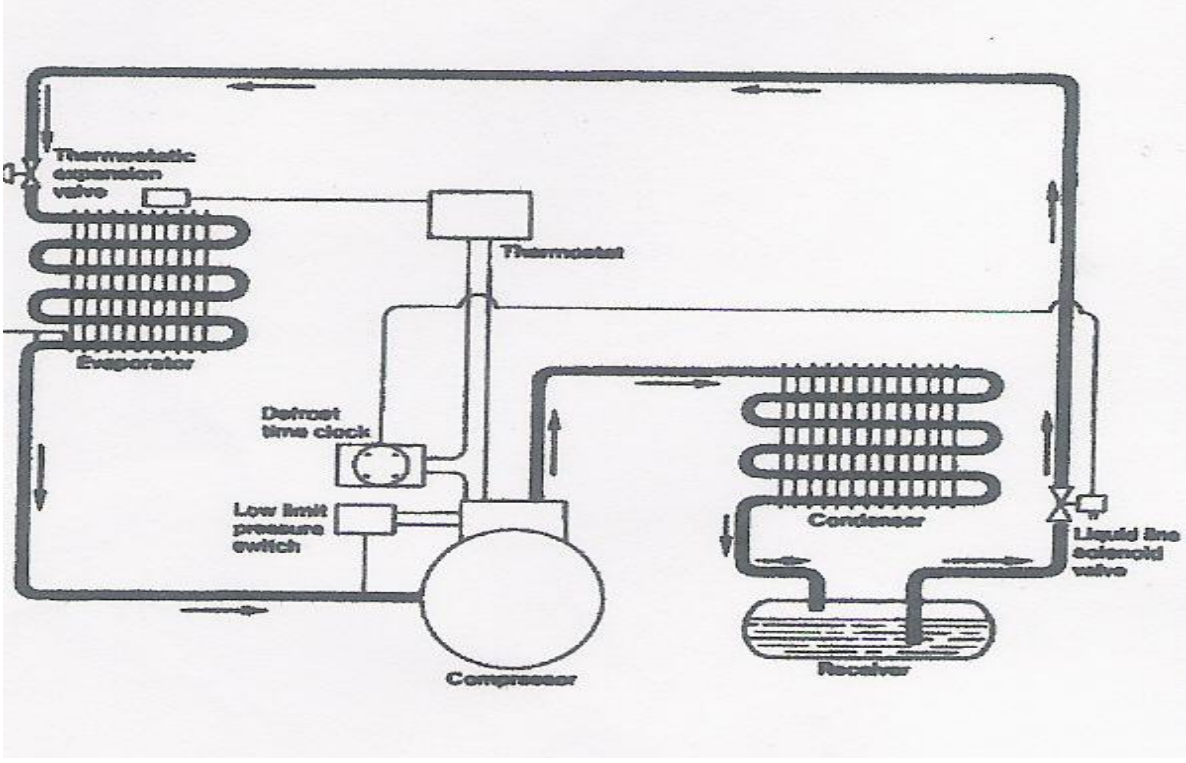

Figure 2.3: Defrost Pump Down

2.1.4 Split Evaporator-Humidity Control

The Split Evaporator-Humidity Control is a type of controller that is related to humidity. There are often times when air temperature is satisfactory but the humidity level is too high. This can be remedied by using half the evaporator to dehumidify the air without excessive cooling and the addition of auxiliary heat. This can be accomplished by using a normally open solenoid valve on one half of the evaporator controller by a humidistat.

Figure 2.4 represent the split evaporator humidity control. This type of controller is controlling humidity with its two split evaporators. The flowing of liquid from compressor to evaporators is accomplished by normally open solenoid valve. From the figure, the split evaporators is separate for satisfactory of humidity level.

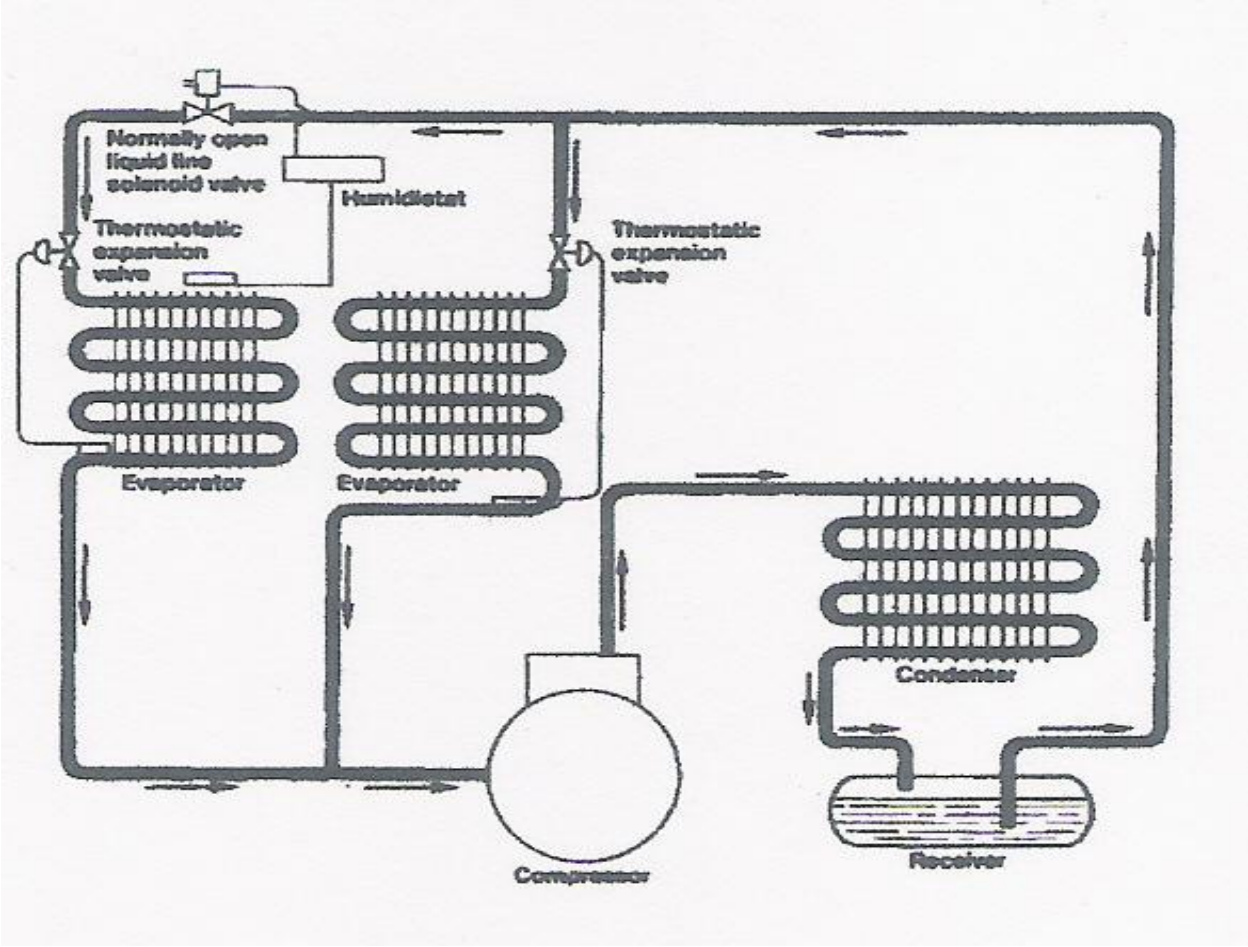

Figure 2.4: Split Evaporator-Humidity Control