Pharmaceutical Tablets Counting and Monitoring System

Phyoe Sandar Win[1], Myo Maung Maung[2], Hla Myo Tun[3]

Abstract— **The control design of the tablet counting machine is the type of the IR feedback control system. It is one of requirement machine of the tablet medicine factory. In the first study, the operation system of the counting machine is designed and developed. It is the Brushed DC motor based controlled by the micro controller control method. The IR sensor is used for the capture of the tablet passing in the key way. The PIC 16F877A is used in the design. Software is developed in C language is using mikro-C programming. The LCD module is used to display the counting number of the tablet by rotary plate. The infrared Sensor is received the IR ray by IR LED. The IR LED generated the IR ray by PWM function of the controller. If the Sensor received the IR ray, the output TTL signal of the sensor is 0. If the sensor not received the IR ray, the output of the sensor is 1. When the tablet is passing through the key way, the tablet is passed between the IR sensor. So the IR ray is block to IR sensor. The controller is captured this state output of IR sensor and display on LCD by character number. This machine is used in many tablet factories in usefully. This instrument is low cost, low power consumption, reliable to many users available.**

Index Terms— Brushed DC motor, IR sensor, PIC microcontroller.

I. INTRODUCTION

This machine is mainly used for tablets counting operations. The process is automatic and continuous operations. This machine is used in tablet counting and count for other types of the medicine. The machine can also be used in different types of the tablets if being installed with size and the forming of tablets. The vibration motor of the machine can be shaking for the falling of the tablets is easily. The structuring of the machine has been designed in order to achieve the mul4ple plane vibra4on by suitable assembly of the specially designed Vibratory motor (constructed for this purpose) having eccentric weight at the top and bottom ends of the motor shaft.

The motor is mounted ver4cally at the center of the screening assembly, on a circular base by means of springs which allow the Unit to vibrate freely. The springs absorb the vibra4ons and prevent them to be transmitted on the floor. The top weight causes vibra4on in the horizontal plane which causes the material to move across the screen towards the Periphery. The lower weight acts to 4lt the machine which causes vibra4on in the ver4cal tangen4al axis. The angle of lead of the lower weight with rela4on to the upper weight provides variable control of the screening pattern.

The overall block diagram of the system is shown in Figure. 1. In this system mainly consists of IR sensors, PIC microcontroller and Brushed DC motor. IR sensor will sense the flow of the tablets. The Counting motor carries the tablets and loses toward the way. The IR sensor captured the tablet individually. And send output data to PIC 16F877A. The counting motor and vibration motor are controlled by controller. The overall process is display on the LCD module.The buzzer is used for alarm for next package and for the full of the specified no.of tablets. The mikro C programming software is used for the control procedure of the system and this saturation is demonstrated by the simulation of the proteus software.

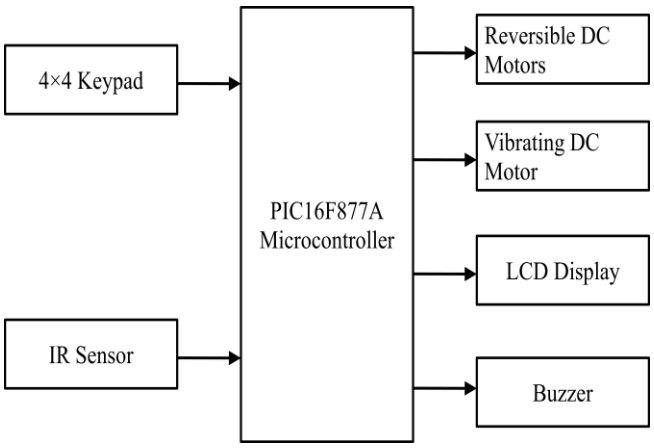

Fig. 1.Block Diagram of the System

II. BACKGROUND THEORY

Fig.2. Design of Paracetamol Tablets

Dispensing medications in a community pharmacy before the 1970s was a time-consuming operation. The pharmacist dispensed most prescriptions that were in tablet or capsule form with a simple tray and spatula. Many new medications were being developed by pharmaceutical manufacturers at an

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ever-increasing pace, and the prices of those medications were rising steeply. A typical community pharmacist was working longer hours and often forced to hire additional staff to handle increased workloads. This extra workload did not allow the time to focus on safety issues. This new factor led to the concept of using a machine to count medications.

The original electronic portable digital tablet counting technology was invented in Manchester, England between 1967 and 1970 by the brothers John and Frank Kirby.

I had the original idea of how the machine would work and it was my patent, but it was a joint effort getting it to work in a saleable form. It was 3 years of very hard work. I had originally studied heavy electrical engineering before changing over to Medical School and qualifying as a Medical Doctor in 1968. In fact I was Senior House (Casualty) Officer (A&E or ER) in 1970 at North Manchester General Hospital when I filed the patent. I must have been the only hospital doctor in Britain with an oscilloscope, a soldering iron and a drawing board in his room in the Doctors' Residence. The housekeepers were bemused by all the wires. Frank originally trained as a Banker but quit taking a job with a local electronics firm during the development. He died in 1987, a terrible loss.

Frank and John Kirby and their associate Rodney Lester were pioneers in pharmacy automation and small-object counting technology. In 1967, the Kirbys invented a portable digital tablet counter to count tablets and capsules. With Lester they formed a limited company. In 1970, their invention was patented and put into production in Oldham, England. The tablet counter aided the pharmacy industry with time-consuming manual counting of drug prescriptions. In 1975, the digital technology was exported to America. Between 1982 to 1983, two separate development facilities were created. In America, overseen by Rodney Lester; and in England, overseen by the Kirby brothers. In 1987, Frank Kirby died. In 1989, John Kirby moved his facility to Devon, England.

A counting machine was found to consistently count medications accurately and quickly. A system of pharmacy automation was quickly adopted, and innovations emerged every decade to meet the needs of the pharmacy industry to deliver medications quickly, safely, and economically. Modern pharmacies have many new options to improve their workflow. This requires them not only to use the new technology, but to work out how to choose intelligently from the many options available.

III. EXPERIMENTAL

A. *Hardware Design*

The simple case of the tablet counting machine includes machine frame, rotatory plate, PIC microcontrollers, and IR sensor and key way of the system.

i. *Mechanical Structure*

The hardware design of the tablet counting machine is constructed by four steps. In the first step, the frame of the machine is designed by plastic plate. The plastic plates are cut in the desired requirement ant each pieces are attached in the formed of the machine.

Figure.3. Design of tablet counting system

In the second step, the brushed DC motor is constructed the middle of the frame and rotate the plate of the carrier. The tablets on the plate are moved to the desired way by the inserting of the shape of the arc plastic piece on upside of rotary plate.

Fig.4. Design of rotary plate

In the third step, the place of the tablets on the rotary plate is shaking by the vibration motor and spring in the base of the plant. This state is shown in below:

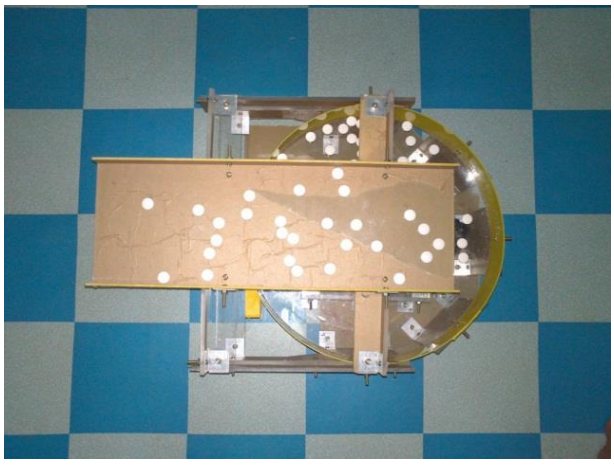

Fig.5. Design of tablets plant on rotary plate

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In the final step, the movement of the desired tablet is falling to the key way of the frame and this way is sense by the IR sensor. The IR sensor is capturing the passing through of the tablet.

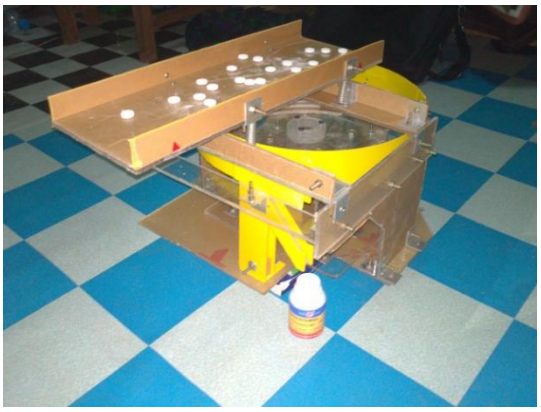

Fig.6. Design of key way

ii. Operation circuit

The circuit diagram of the tablet counting machine is composed by five parts. They are key pad, micro controller PIC16F877A, 16*2 LCD and DC motor with relay driver circuit. The key pad is used for data input to PIC and LCD is the display output of the system. The required amount of tablet is type by keypad. The keypad has the digit number 0-9, A, B, C, D and character value *, #. The char * button is used to accept the number of tablets and # button is for clear the numbers of tablet. The digit 0-9 buttons are used for required amount of tablets. The char A-D is non-operation. The welcome screen and amount of tablets is shown in LCD. The PIC controller is start to drive the DC motors (counting and vibration motor) at the button * is pushed. The IR sensor is used for crossing of tablets. If the one tablet is across the IR sensor, the sensor sends the digital data 0 to micro-controller.

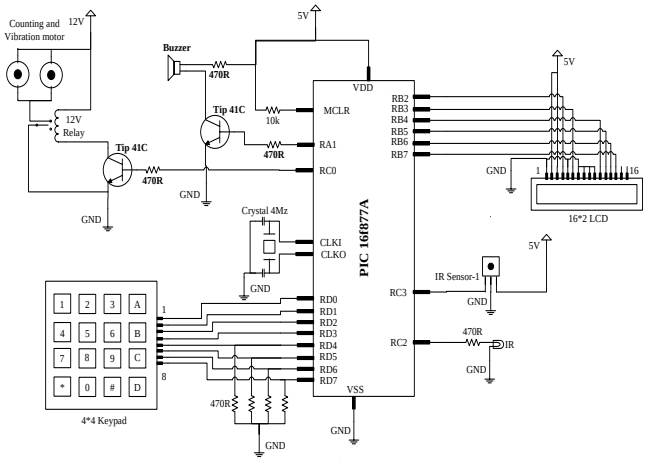

Fig.7.System Design of tablet counting machine

iii. LCD module

The counting numbers are displayed on the LCD module. In this system we used PC 602-F (16x2 characters) LCD display. The LCD connects with the 6 pins of micro-controller, 2 pins for back-light LED and 2 pins for power supply. The 6 pins of LCD are 4 parallel pins for data control and 2 pins for Enable, instruction/register select pin.

The send data of controller through the D4-D7 pins of LCD.

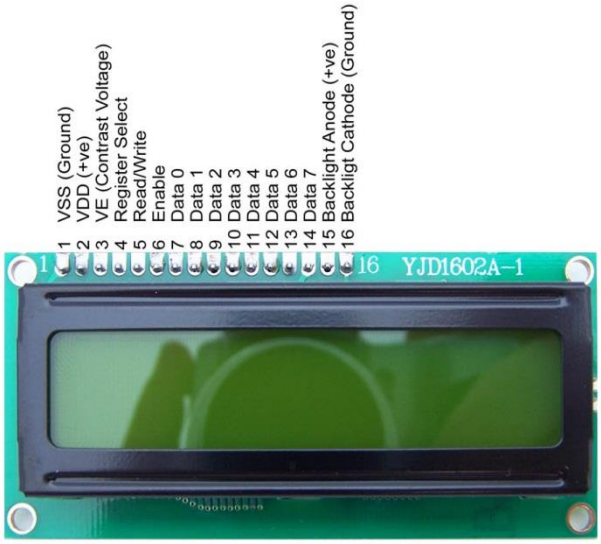

Fig.8. Configuration of LCD module

The backlight in this LCD is composed of LEDs in series. The total voltage drop across these LEDs is typically 4.2 V and the recommended current through the LEDs is 120 mA. You should use a current limiting resistor RLIMIT as shown above where:

iv. IR LED and IR Sensor

Fig.9. Configuration of IR LED

An IR LED, also known as IR transmitter, is a special purpose LED that transmits infrared rays in the range of 760 nm wavelength. Such LEDs are usually made of gallium arsenide or aluminum gallium arsenide. They, along with IR receivers, are commonly used as sensors.

This LED is used for the generated the IR ray to operation of the sensor and for the passing part of the tablets in the key way

An infrared detector is a detector that reacts to infrared (IR) radiation. The two main types of detectors are thermal and photonic (photo detectors).

This is used for the capturing of tablet passing and sends the TTL logic data to micro-controller for counting of tablet numbers.

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v. Main Microcontroller

In this project, PIC16F877A microcontroller is used. It is forty-pin enhanced FLASH/EEPROM eight-bit microcontroller. It belongs to mid-range family of the PIC micro microcontroller devices.

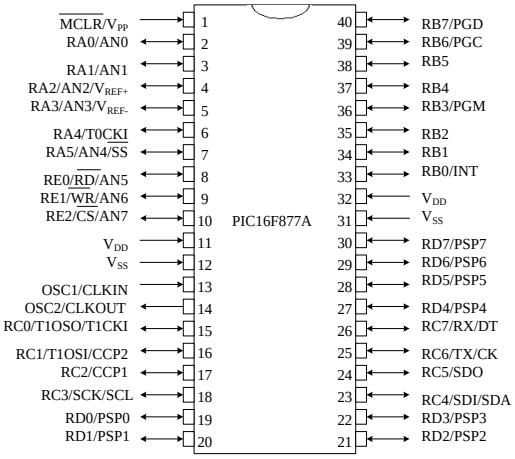

Fig. 10. PIC Pin Assignments for the Control System

PIC16F877A has five I/O ports, Port A, B, C, D and E. Some pins for these I/O ports are multiplexed with an alternate function for the peripheral features on the device. In general, when a peripheral is enabled, that pin may not be used as a general purpose I/O pin.

vi. Brushed DC motor

A brushed DC motor is an internally commutated electric motor designed to be run from a direct current power source. Brushed motors were the first commercially important application of electric power to driving mechanical loads.

A brushed DC motor is rotated the circular plate which is carried the required number of tablets. This DC motor is control by the relay driver circuit and based control by controller for count tablets.

Fig.11. Brushed DC motor

vii. Vibration Motor

Small vibration motors have been with us since the 1960's. Initially they were developed for massaging products, but development took a new turn in the 90's when consumers required vibra-call on their mobile / cell phones. Today, designers and users alike have learned from two decades of mobile phones, that vibration alerting is an excellent way to alert operators of an event.

This vibration motor is used to fall the tablet on the plant of the frame to the rotary plate and control by the PIC controller. Vibration motor is worked the same time to rotary motor.

Fig.12. Vibration motor

viii. KEYPAD

The Keypad 4x4 features a total of 16 buttons in Matrix form. This is a membrane keypad with no moving parts.

Fig.13. Keypad

This key pad is used for the required amount of the tablets to package in the system. It has 8-pins of the data lines and connected to the 8-pins of the controller. The controller read the data from keypad and calculates the desired amount of the tablets to display on Liquid crystal display in step by step.

B. Software configuration

If the program is start the PIC wait for LCD to show the welcome screen and prepare for the data input screen. Then the PIC ready to accept the data of keypad. If the keypad data is received the PIC drive the counting motor to rotate by relay driver and vibrate the vibration motor. When each tablet is across the IR sensor, PIC counted the no of tablets and sends the data to LCD for display the counting of tablet. If the specified amount of tablet is filled to package, the PIC updated the no of package into 1 and alarm by buzzer. And then PIC waited 7 seconds for next package and the program goes to start and loop again. But power restart is required for the amount of tablet is wanted to change from keypad.

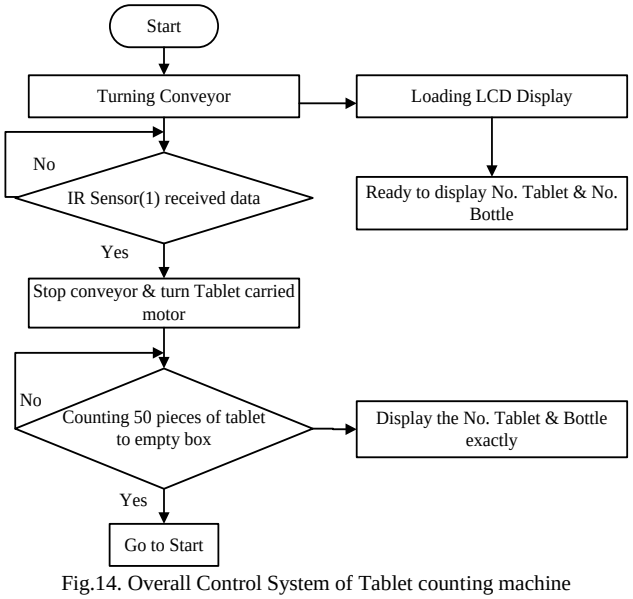

Fig.14. Overall Control System of Tablet counting machine

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i. Mikro-C Programming Software

MikroC is one of the powerful and easy to use software for programming PIC microcontrollers in embedded C. MikroC is a powerful, feature rich development tool for PICmicros. It is designed to provide the customer what the easiest possible solution for developing applications for embedded systems, without compromising performance or control. Applications can be developed quickly and easily using MikroC for PIC microcontrollers. It provides a simple windows based point-and-click environment for developing applications.

```
unsigned short kp;
char txt[5];
unsigned int i;
unsigned char
tablet_1,tablet_2,package_1,package_2,a,a_1,a_2,a_3,cnt;
void loading(){
  //write(....)on LCD Screen*****
  Lcd_Custom_Chr_Cp('.') ;
  Delay_ms(700);
  Lcd_Custom_Chr_Cp('.') ;
  Delay_ms(700);
  Lcd_Custom_Chr_Cp('.') ;
  Delay_ms(700);
  Lcd_Custom_Cmd(LCD_MOVE_CURSOR_LEFT);
  Delay_us(500);
  Lcd_Custom_Cmd(LCD_MOVE_CURSOR_LEFT);
  Delay_us(500);
  Lcd_Custom_Cmd(LCD_MOVE_CURSOR_LEFT);
  Delay_us(500);
  Lcd_Custom_Out_Cp("   ") ;
  Lcd_Custom_Cmd(LCD_MOVE_CURSOR_LEFT);
  Delay_us(500);
  Lcd_Custom_Cmd(LCD_MOVE_CURSOR_LEFT);
  Delay_us(500);
  Lcd_Custom_Cmd(LCD_MOVE_CURSOR_LEFT);
  Delay_ms(700);
          }
```

Fig.15.Compiling the Program using MikroC

PIC and C fit together well: PIC is the most popular 8-bit chip in the world, used in a wide variety of applications, and C, prized for its efficiency, is the natural choice for developing embedded systems. MikroC provides a successful match featuring highly advanced IDE, ANSI complaint compiler, broad set of hardware libraries, comprehensive documentation, and plenty of ready-to-run examples.

IV. Simulation Result of the System

The result of the this system is shown by the proteus 7.7 software. This state is known the function of the system without test in outside and suitable for test region of system.

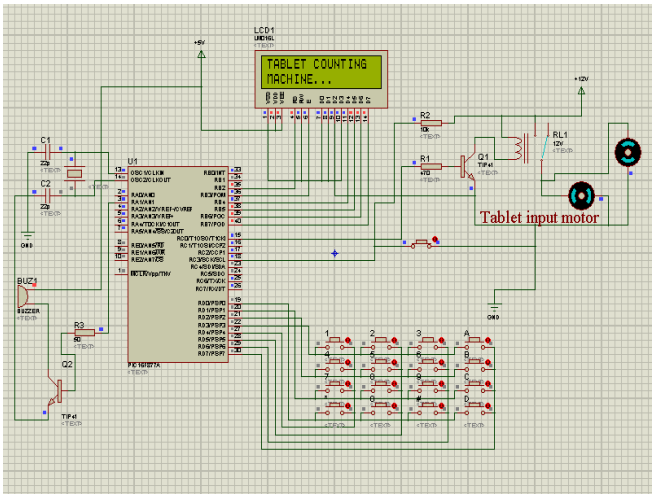

Fig. 16. Software Simulation of Tablet Counting System (Before Giving IR Sensing)

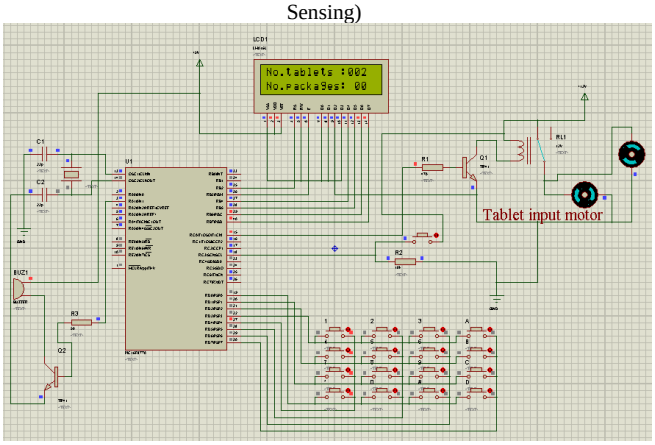

Fig. 17. . Software Simulation of Tablet Counting System (After Giving IR Sensing)

V. Summary

The hardware design and software implementation of the tablet machine control system is described. The desired programming software is used in mikro-C for PIC controller. This system is counted for the many numbers of tablets in good accuracy. Our system can count the hundred numbers of tablets in one minute and low power required for the machine. This machine is very suitable for the tablet factory and the many tablet shops. The IR sensor of the system is the best efficiency for the system, changeable data of the amount of the desired number of tablets and nice display in LCD module. These are reliable parts of the system for compared to other.

VI. Conclusion

Automated microcontroller based pharmaceutical tablets counting and monitoring system will describe and illustrate the number of tablets during their handling and processing. This system is to count the tablets by using the IR sensors, DC motor and controller. We can add other function for tablets counting machine such as conveyor, packaging etc. It is not only controlled with brushed dc motor but also stepper used for more effective machine. This system is considered as a satisfying accomplishment. The PIC16F877A works steadily with the electronic hardware and the program is function well with no major error occurred. This system provides for longer intervals between required maintenance operations, and therefore reduces the cost of operation. It is

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hopefully to reduce human contact in tablets counting. This system is very useful for Pharmacist industry.

REFERENCES

[1] John KirbyFiled 8September1970 (3July1974)."Patent1358378" (http://www.oti.com/oti/patent/19740703-1358378-GB-A).COUNTINGMACHINES-PatentGB1358378(A).DTIDataNetworksLLC.Retrieved18March2010

[2] A United States Patent Office (29 January 1974). "Patent 3789194" (http://www.freepatentsonline.com/3789194.html).RELATING TO COUNTING MACHINES. Freepatentsonline.com. Retrieved 6 March 2010

[3] A "An Efficiency Analysis of the Kirby Lester KL16df Automatic Tablet and Capsule Counting System"(http://thethomsengroup.com/TTGI%20Pages/Articles%20Studies%20&%20Presentations/ThomsenGroup%20KL%20Study%202004.pdf). Pharmacy Automation. The Thomsen Group Inc. 2004.Retrieved 5 March 2010

[4] A "Labels, patient information leaflets and packaging for medicines" (http://www.mhra.gov.uk/Howweregulate/Medicines/Labelspatientinformationleafletsandpackaging/index.htm). The Medicines and Healthcare products Regulatory Agency (MHRA). 2010. Retrieved 8 March 2010

[5] A Lagrange F: [Current perspectives on the repackaging and stability of solid oral doses]. Ann Pharm Fr; 2010 Nov;68(6):332-58 http://www.sciencedirect.com/science/article/pii/S0003450910001331

[6] Lander, Cyril W. (1993). "8 D.C. Machine Control". Power Electronics (3rd ed.). London: McGraw Hill International UK. ISBN 0-07-707714-8

[7] Herman, Stephen L. Electric Motor Control. (http://books.google.com/books?id=Yxy8WRWfIy0C&pg=PA12&dq=dc+electric+motor+protection&hl=en&ei=xwC8TrefFOHq0gHW4czfCQ&sa=X&oi=book_result&ct=result&resnum=9&ved=0CHAQ6AEwCA#v=onepage&q=dc%20electric%20motor%20protection&f=false) 9th ed. Delmar, Cengage Learning, 2009. Page 12

[8] Malcolm Barnes. Practical variable speed drives and power electronics. (http://books.google.com/books?id=LxW9F9WCixcC&pg=PA151&dq=dc+motor+insulation+failures&hl=en&ei=UCrATsnlK-j30gG_s7i3BA&sa=X&oi=book_result&ct=result&resnum=3&ved=0CD4Q6AEwAjgK#v=onepage&q&f=false) Elsevier, Newnes, 2003. Page 151

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