4 CHANNEL BLOOD URINE AND GLUCOSE MEASUREMENT SYSTEM

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THIS REPORT PRESENTED TO:
ELECTRICAL ENGINEERING DEPARTMENT
POLYTECHNIC OF SULTAN SALAHUDDIN ABDUL AZIZ SHAH

PROJECT REPORT

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To fulfill the requirement of

Diploma in Electronic Medical Course

CONTENTS

Appendix list

TESTIMONIAL

Hereby, we would like to declare that this project was developed and produced based on our own efforts and work, expect; some references and appendix that are attached together with this report.

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ACKNOWLEDGEMENTS

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Abstract / synopsis

Our project is about how to know the contains of blood and glucose by using urine as a sample. This is a measurement system by using hardware and software. We use Microsoft Visual Basic 6.0. This project used a Stepper motor with a specific function that means move clockwise, and stops at 4 axis. At the stepper motor we put the specimen which it is to receive and transmit. From here infra red sensor will detect to the specimen.

After that it will go to the second sensor and second sensor will detect to the pH paper. And then go to amplifier to amplify signal from the sensor and to the analogue digital (ADC). From here it wills connection to the computer. Lastly the result will out in digital form. The product is designed and constructed as a PCB board.

Besides that, it enables fast, easy using new technology, which is more reliable and can give information with more exactly. All process will control by computer.

CHAPTER 1

INTRODUCTION

CHAPTER 1 : INTRODUCTION

1.1 INTRODUCTION

Every last semester for engineering course, the student are requiring to do one project. To build a project we must know the specification and application of our project from our knowledge, we know our project are based in industrial. Our project title is "4 channel blood urine and glucose measurement system".

Nowadays, aims of new technologies are to enhance and make - work easier. Recently factories sector is one example that using new technologies. Works are needed to enhance the performance of machine, therefore increase the production to fulfill human's requirement. So, the propose of application of new technologies is to simplify the task because sometimes the new technologies utilize simple method by having the ability to yield many products in short time with low cost .

Furthermore, our final project almost fulfills that scenario which we desire to try to overcome a lot of problems that occurred in the industrial sector. Therefore, we like to introduce our final project titled " 4 channel blood urine and glucose measurement system". The selectivity product is mainly used for factory medical centre in engineering department. Actually, selectivity process is a common feature at anywhere in industry workplace. Anybody can easily get the materials such stepper motor, infra red sensor, amplifier, ADC. Beside that, our project also using software likes Microsoft Visual Basic 6.0. From this software, we can get the result and information about blood urine glucose and all programs are control by the software.

1.2 PROBLEM

Before this, there is no system to measure blood urine and glucose. After a research by scientist they decided to make an equipment which can measure the quantity of blood urine and glucose. So we make up our mind to rebuild this project. This is an indirect method for measuring blood sugar. It is a more direct method of monitoring the blood glucose level. Most health care professionals prefer this system because of the limitations of urine testing.

This project can be useful to the person that want to know their level of the urine test either they get high limit or low limit.

1.3 AIMS AND OBJECTIVES

1.3.1 To design and construct a project that can give information about blood glucose and urine in the human body.

1.3.2 It saved times, fast application and easy to use in the industry because technology simple by using motor system and less material.

1.3.3 The existing design can be improve in the future by adding more channel in motor system such can be detect types of disease in blood glucose, rates nutrient, temperature in the body and others .

1.3.4 This project gives an experience to the student to be more cooperation, coordination and communication with each other.

1.3.5 Prepare the student for real job in the future.

1.3.6 This also trains the student to complete the project on time.

1.4 PROJECT SCOPE

While we complete this project, we must make sure that this project is applicable with the course that we are studying now. It is important because it will make us easy to complete the project. We should fully understand the function and the used of the project.

This will help us when we presented the project. Beside that, we can get more knowledge about the electronic project and the operation of the circuit.

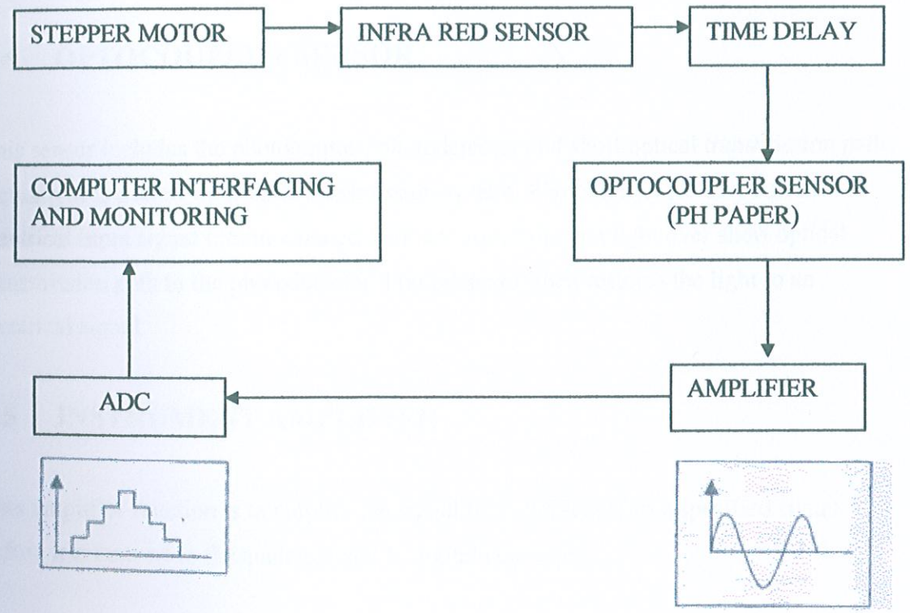
Project supervisor also can analyze the aspect of the student like the ability and knowledge of the student.

CHAPTER 2

PROJECT BACKGROUND

CHAPTER 2 : PROJECT BACKGROUND

2.1 BLOK DIAGRAM



2.2 STEPPER MOTOR

The motor will clockwise and take the information. After that the information will read.

2.3 INFRA RED SENSOR

Infra red sensor will detect the information from the stepper motor and then stop the motor when specimen (pH paper) at the detector axis. Then transmitted information to second sensor (optocoupler sensor).

2.4 OPTOCOUPLER SENSOR

This sensor includes the photoemitter, photodetector and short optical transmission path. Actually it is a short fiber optic transmission system. Photoemitter (IRED) current electrical input signal into modulated light and transmits that light over short optical transmission path to the photodetector. Photodetector then restores the light to an electrical signal.

2.5 INSTRUMENT AMPLIFIER

This amplifier function is to amplify the signal from the sensor to a specified signal before it is convert to the analogue and to digital converter.

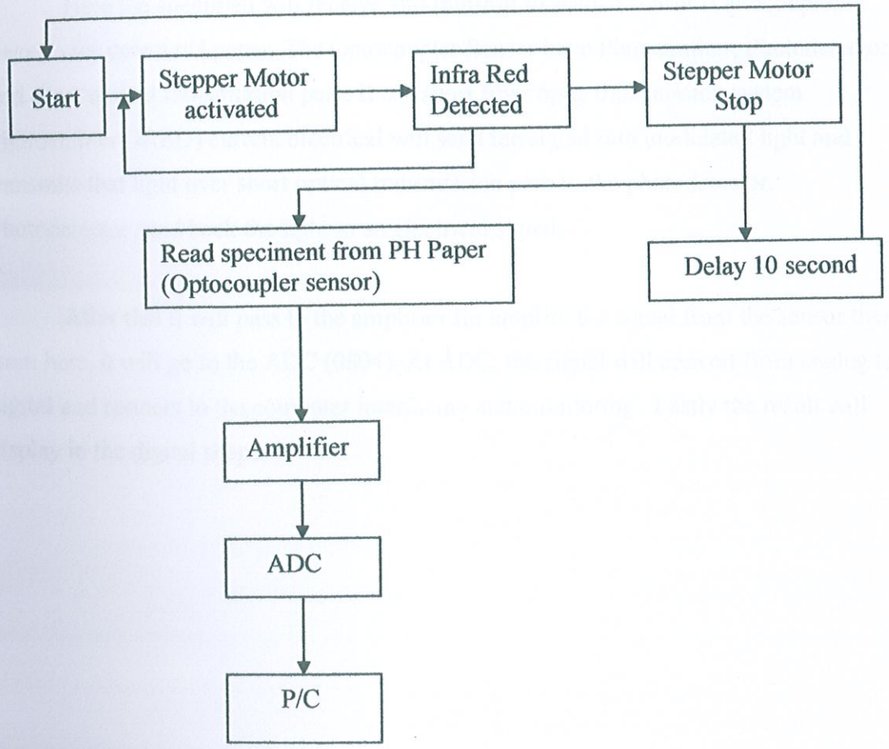
2.6 ANALOGUE TO DIGITAL

This ADC function is to convert the analogue signal to digital signal.

2.7 COMPUTER INTERFACING AND MONITORING

Software design by using the Microsoft Visual Basic 6.0 should be interface it to the hardware.

2.8 FLOW CHART



2.8.1 FUNCTIONALITY

First when the switch is "ON" the stepper motor will operate by rotate to clockwise. The specimen is place at the stepper motor. In this project we will use urine as a sample. The urine will dropped to the pH paper and put it at the motor. When the stepper motor arrive the axis, it will stop in time delay 10 seconds. In this time, the infra red sensor will detect specimen at stepper motor.

Here the specimen will receive and transmit to second sensor (Optocoupler Sensor) for detect pH paper. The Optocoupler Sensor have Photoemitter, Photodetector and short optical transmission path. It is a short fiber optic transmission system. Photoemitter (IRED) current electrical will send the signal into modulated light and transmits that light over short optical transmission path to the photodetector. Photodetector send back the light to an electrical signal.

After that it will pass to the amplifier for amplify the signal from the sensor then from here, it will go to the ADC (0804). At ADC, the signal will convert from analog to digital and connect to the computer interfacing and monitoring . Lastly the result will display in the digital shape.

2.9 STEPPER MOTOR

2.9.1 THE USE OF STEPPER MOTOR

Stepper motor provide considerable advantages over dc motors. Under a PIC controller, stepper motors may be used for precise positioning in a wide range of applications, including robotics, automation, animatronics and positioning control.

Stepper motors operate differently from dc motors. When power is applied to a dc motor, the rotor begins turning smoothly. Speed is measured in revolutions per minute (rpm) and is a function of voltage, current and load on the motor. Precise positioning of the motor's rotor is usually not possible or desirable.

A stepper motor, on the other hand, runs on a sequence of electric pulses to the windings of the motor. Each pulse rotates the stepper motor's rotor by a precise increment. Each increment of the rotor movement is referred to as a step-hence the name stepper motor. The incremental steps of the rotor's rotation translate to a high degree of positioning control, either rotationally or linearly if the stepper motor is configured to produce linear motion. The incremental rotation is measured in degrees.

Stepper motors are manufactured with varying degrees of rotation per step. The specifications of any particular stepper motor will always state the degree of rotation per step. The stepper motors can be find with degree per step that vary from a fraction from a degree (0.12°) to many degrees (e.g., 22.5°).

2.9.2 STEPPER MOTOR CONSTRUCTION AND OPERATION

Stepper motor are constructed using strong permanent magnets and electromagnets. The permanent magnets are located on the rotating shaft, called the rotor. The electromagnets or windings are located on the stationary portion of the motor, called the stator. The stator, or stationary portion of the motor surrounds the rotor.

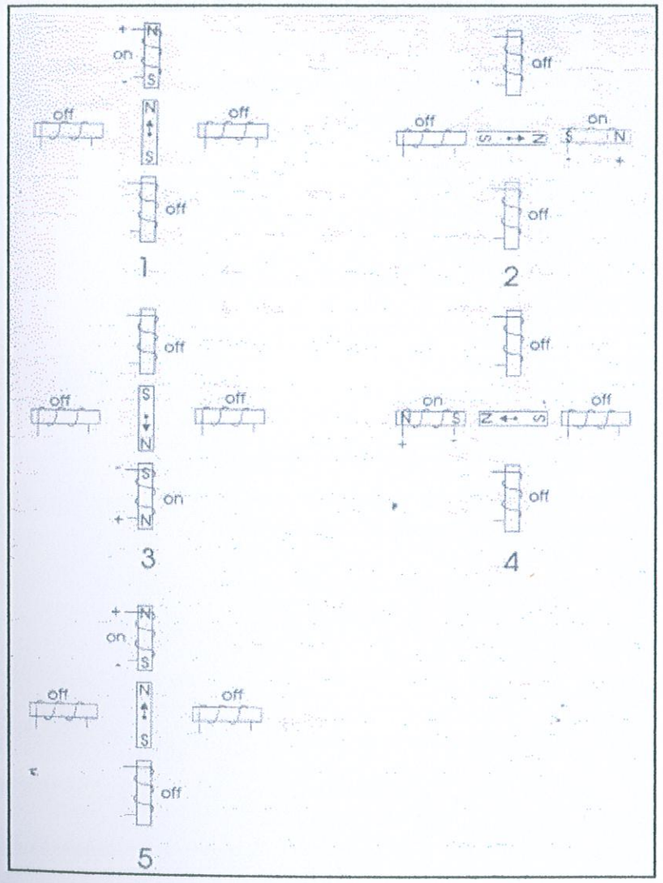


Figure 2.1 Stepper motor going through one rotation

Figure 2.1 Stepper motor going through one rotation

In figure 2.1, position 1, it start with the rotor facing the upper electromagnet, which is turned on. To move the rotor in a clockwise rotation, the upper electromagnet is switched off and the electromagnet at the right is switched on. This will causes the rotor to rotate 90° clockwise to align itself with the electromagnet, shown in position 2.

Continuing in the same manner, the rotor is stepped through a full rotation until it end up in the same position as it started, shown in position 5.

2.9.3 HALF STEPPING

Half stepping is the process to the double the resolution of stepper motor. The process is illustrated in figure 2.2 below. In position I, the motor starts with the upper electromagnet switched on. In position II, the electromagnet to the right is switched on while power to the upper coil remains on. Since both coils are on, the rotor is equally attracted to both electromagnets and positions itself in between the two positions (a half step). In position III, the upper electromagnet is switched off and the rotor completes one step. The motor can be half stepped through the entire rotation.

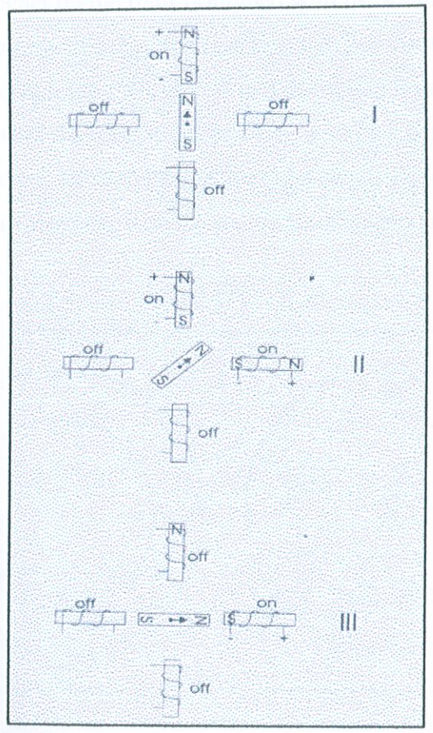


Figure 2.2 Half stepping

2.9.4 THE REAL WORLD MOTOR

The stepper motor illustrated in figure 2.1 and 2.2 rotated 90° per step. Real world motor stepper motors employ a series of mini-poles on the stator and rotor. The mini-poles reduce the number of degrees per step and improve the resolution of the stepper motor. Although, the drawing in figure 2.3 appears more complex, the operation of the motor is identical with the motor as shown in figure 2.1 and 2.2.

The rotor in figure 2.3 is turning in a clock wise rotation. In position I, the north pole of the permanent magnet on the rotor is aligned with the south pole of the electromagnet on the stator. Notice that there are multiple positions that are all lined up. In position II, the electromagnet is switched off and the coil to it on the left immediate switched on. This will causes the rotor to rotate clock wise by a precise amount. It continues in the same manner for each step. After eight steps, the sequence of electric pulses starts to repeat. Half stepping with the multipole arrangement is similar to the half stepping.

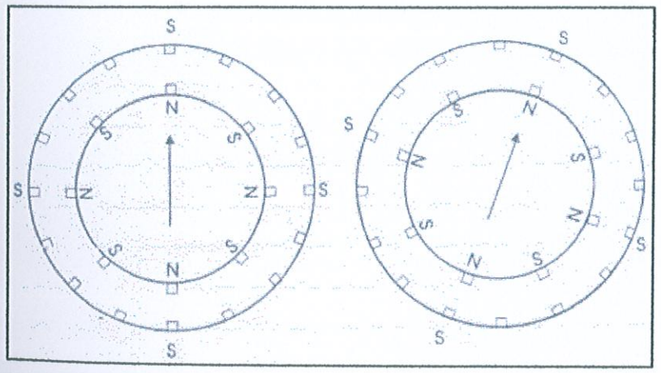


Figure 2.3 High-resolution stepper motor

2.9.5 FIRST STEPPER CIRCUIT

Figure 2.4 is the schematic for our first test circuit. The output lines from the PIC 16F84 are buffered using a 4050 hex buffer circuit. Each buffered signal line is connected to an NPN transistor. The TIP120 transistor is actually an NPN Darlington; in the schematic. It is shown as a standard NPN. The TIP120 transistors act like switches, turning on one stepper motor coil at a time.

The diode is placed across each transistor to protect the transistor from the inductive surge created when current is switched on and off in the stepper motor coils. The diode provides a safe return path for the reverse current. Without the diodes, the transistor will be more prone to failure and / or short life.

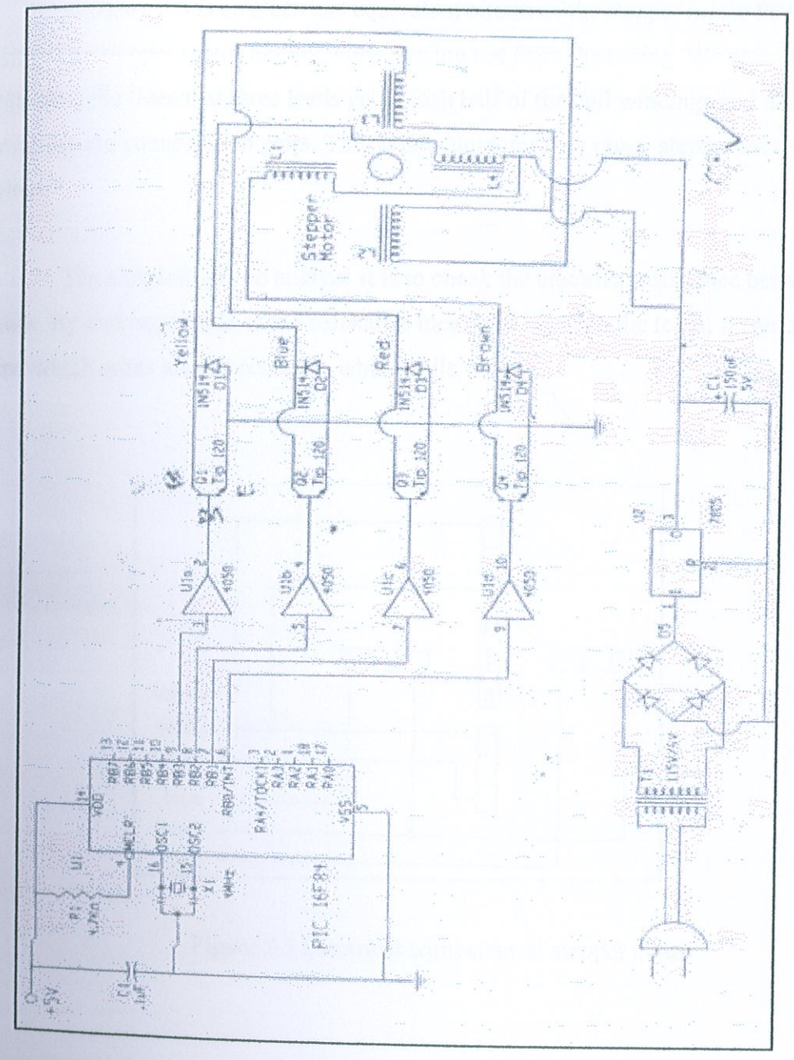


Figure 2.4 Schematic of test circuit

2.9.6 ELECTRICAL EQUIVALENT OF STEPPER MOTOR

In figure 2.5 is an electrical equivalent circuit of the stepper motor that we are using. The stepper motor has six wires coming out from the casing. We can see by following the lines that three leads go to each half of the coil windings and that the coil windings are connected in pairs. This is how unipolar four phase stepper motors are wired.

The simplest way to analyze it is to check the electrical resistance between the leads. By making a table of the resistance measured between the leads, it can be quickly find which wires are connected to which coils.

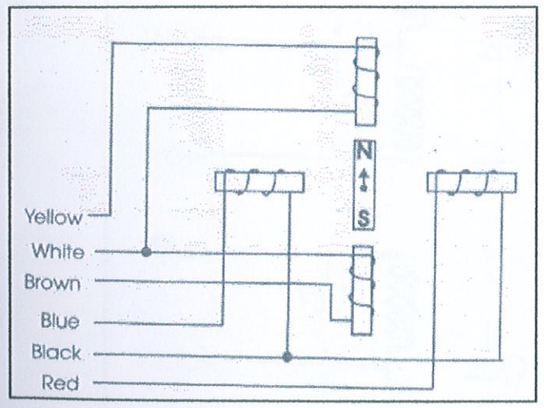


Figure 2.5 Electrical equivalent of stepper motor

Figure 2.6 shows the view of the resistance of the motor that we are using. There is a 13Ω resistance between the center tap wire and each end lead, and 26Ω between the two end leads. The resistance reading from the wires originating from separate coils will be infinitely high (no connection). For instance, this would be the case for the resistance between the blue and brown leads. The stepper motor that we are using rotates 1.8° per step.

With this information, we can figure out just about any six wire stepper motor that come across and wire it properly into a circuit.

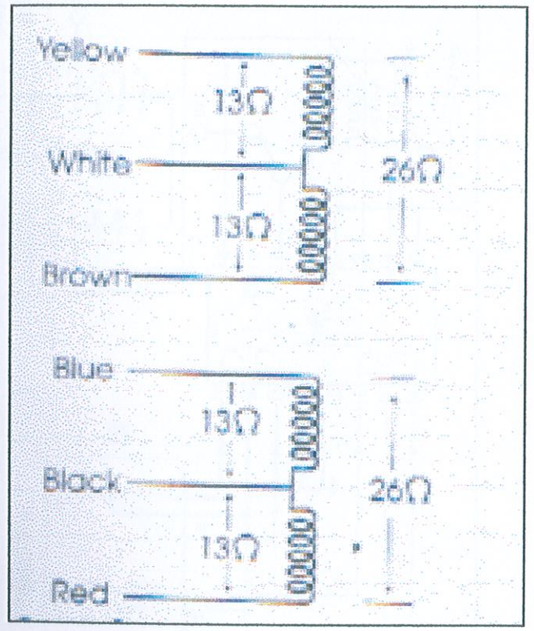


Figure 2.6 Resistance of stepper motor

2.9.7 SCHEMATIC CIRCUIT FOR STEPPER MOTOR

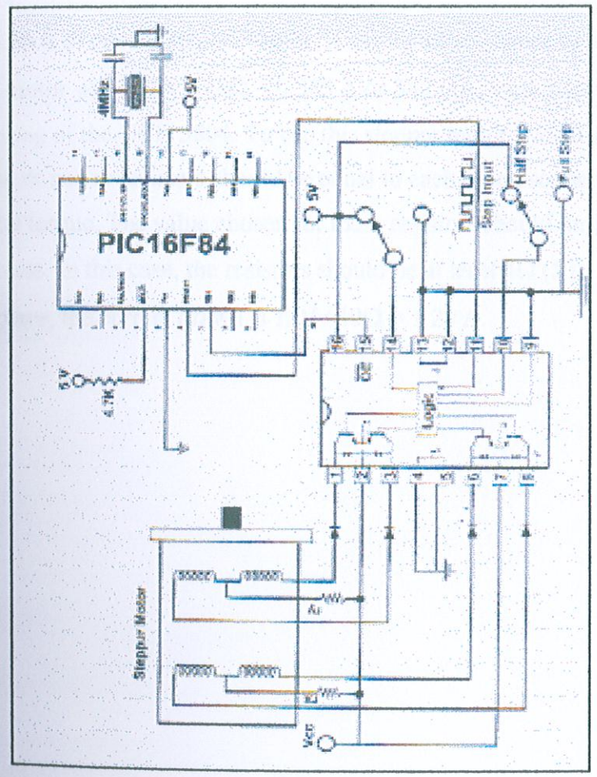


Figure 2.7 Stepper Motor Schematic

The schematic for a stepper motor controller using a dedicated IC is shown in figure 2.7. The UCN 5804 is powered by a 5V dc power supply. While it is internally powered by 5V, it can control stepper motor voltages up to 35V.

In the schematic there are two resistors, labeled rx and ry, that do not show any resistance value. Depending upon the stepper motor, these resistors may not be necessary. Their purposes is to limit current through the stepper motor to 1.25 A (if necessary).

Let's look at our 5V stepper motor. It has a coil resistance of 13Ω. The current draw of this motor will be 5V / 13Ω = 0.385 A or 385 mA, well below the 1.25 A maximum rating of the UCN 5804. To use this stepper motor, we must add the rx and ry resistors. The rx and ry resistors should be equal to each other, so that each phase will have the same torque. The value chosen for these resistors should limit the current drawn to 1.25 A or less. In this case, the resistors should be at least 4Ω (5 to 10W). With the resistors in place, the current drawn is 12V / 10Ω = 1.20 A.

2.10 INFRA RED SENSOR

IR LEDs works like diodes. If one hooks up the positive clip of the ohmmeter to the positive (anode) side of the LED, and negative clip to the negative clip to the negative (cathode) side of the LED, then the ohmmeter should read approximately 0 ohms. If it is in the mega ohm range, then the polarity reversed. For the phototransitor, we can use similar test. First, we have to connect the ohm meter clips to the ends of the detector. Make sure there a desk lamp is not shining directly on the detector. The resistance should be high. Now, we have to shine light on the detector. The resistance should go low. If not the polority is reversed. This method works because white light has some infrared light embedded in it. Lastly, we must make sure that the NPN transistors are in the correct polority.

2.11 INFRARED EMITTER AND DECODER

One encounters infrared (IR) emitter/detector circuits in daily life. For example, there are doors that automatically swing open when a person walks close by or passes a gate. In essence they operate as follows: the emitter passes an infrared beam which is detected by a phototransistor. When a person walks by, he "breaks" the beam. Upon this event, the phototransistor no longer can detect infrared light and another event is triggered- namely the door opens. Such a circuit is described here. This circuit can be easily made within a couple of hours. One can use simple point to point soldering or wire wrap. Because, of the versatility of this circuit and its small size factor, we created printed circuit board (PCB) artwork. The artwork measures approximately 2 inches by 2 inches. Typical copper boards at stores or surplus are large enough so that one can quickly made 4 of these IR boards at the same time.

One quick note about PCBs. We never had good success with iron-on transfer methods. We thus used the rub-on transfer from radio shack. I also imagine you can use the resist ink pen too, since the trace lines not thick and component spacing is not critical.

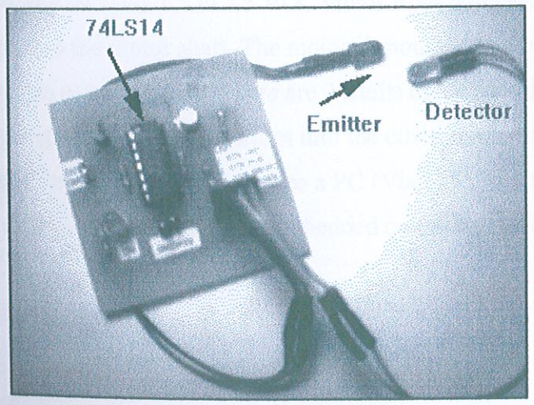


Figure 2.8 Infrared emitter and decoder

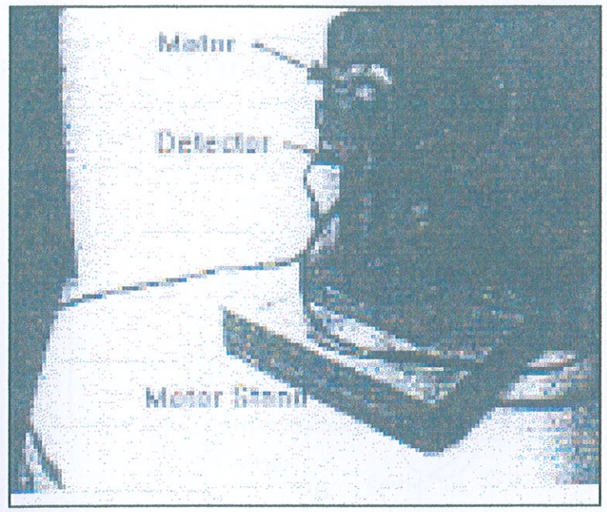


Figure 2.9 Infrared motor and detector

The above photos show how the IR emitter/detector board will be used for motor speed determination. The black circular disc has one hole. The phototransistor can detect the IR emitter's light source though this hole. Thus, only at this point will U1's pin 2 output be high. Since the disk is black the phototransistor will be blocked and pin 2 will always be low. I used the 99 cents 1.5 to 3.5 VDC motor from radio shack (273-223). The black disc mounts on the motor shaft. The motor is mounted in a plastic motor stand. The stand is mounted on piece of wood. There are 2 shafts on either side of the disc. The emitter slides into one shaft. The detector slides into the other. In the future, we will show one can interface the IR emitter/detector board to a PC (Via 8255 PPI board or other commercial digital data acquisition board) or embedded controller (Intel 8051 for example).

2.11.1 THEORY OF OPERATION

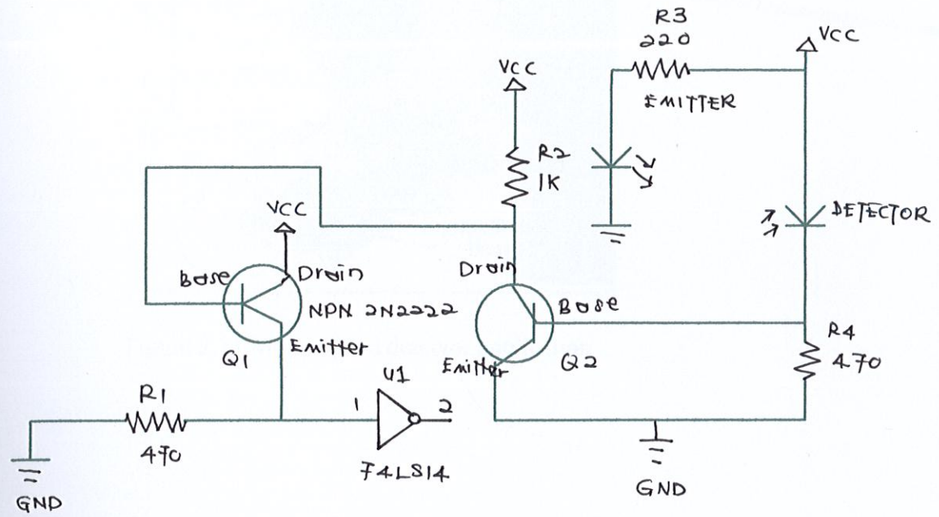


Figure 2.10 Infrared emitter / detector circuit

If the emitter and detector (as known as phototransistor) are not blocked, then the output on pin 2 of the 74LS14 will be high (approximately 5 volts). When they are blocked, then the output will be low (approximately 0 volts). The 74LS14 is a Schmitt triggered hex inventer. A Schmitt trigger is as signal conditioner. It ensures that above are threshold value, will always get clean HIGH and LOW signals.

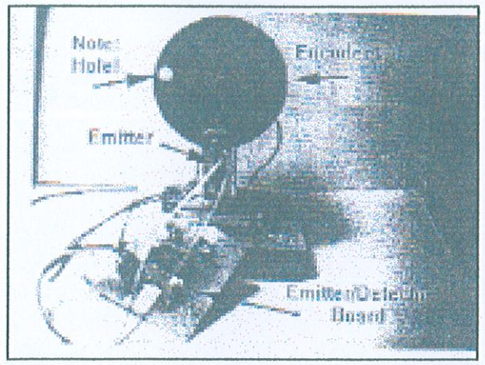


Figure 2.11 Motor speed detector application

Figure 2.11 Motor speed detector application

CHAPTER 3

CLINICAL THEORY

CHAPTER 3 : CLINICAL THEORY

3.1 SELF MONITORING OF BLOOD GLUCOSE

Self monitoring of blood glucose and urine testing are guides to diabetes control. Urine testing is an indirect method for measuring blood sugar. Self monitoring blood glucose is a more direct method of monitoring the blood glucose level. This self monitoring have the following limitation of urine testing :

- This self monitoring cannot test low blood sugar (hypoglycemia) with urine testing.
- Sugar shows up in urine only when the blood glucose level exceeds the kidney threshold and this threshold could be high.
- Because urine collects in the bladder over time, urine testing provides general information on blood glucose level over a few hours, rather than exact information on the level at test time.
- Self monitoring blood glucose allows to determine the pattern of blood glucose levels and make necessary changes in diet and exercise program or insulin dose.
- With self monitoring blood glucose, we can measure precisely the effects of changes in exercise, diet and insulin on the blood glucose level.
- Self monitoring blood glucose can avoid insulin reactions.
- The precise, immediate information provided by self monitoring blood glucose allows the user to respond quickly to an elevation or decline in blood sugar.
- During an illness, the accurate information provide by this monitoring can serve as a basis for treatment.

3.2 SELF MONITORING BLOOD GLUCOSE INSTRUCTIONS

Self monitoring blood glucose instructions vary, depending on the meter or sensor we use. We must carefully follow the instructions for our devices. All self monitoring blood glucose tests require a drop of blood. The side of the tip of the middle or ring finger is usually the most convenient and least painful place to obtain blood, but we can also use any finger or even an earlobe. Using the same finger (or pair of fingers) causes a callus to build up. You'll feel less discomfort but still obtain enough for each test.

Here are the steps for obtaining a drop of blood:

1. Wash hands with soap and warm water and dry them completely or clean the area with alcohol and dry completely.
2. Prick the finger tip with a small, pronged lancet. A spring lancet device gives a quick puncture with less discomfort.
3. Hold hand down, and milk the finger from the palm towards the tip. If little blood appears, wait a couple seconds and milk again. Do not squeeze close to the puncture.
4. Turn your hand palm down, so that the drop hangs.
5. Catch the drop of blood on the special test strip pad or designated area.
6. Record the test result.

3.3 THE LEVEL OF BLOOD GLUCOSE

For some people, a blood sugar level below 80 mg is too low, while for others a level under 100 mg is too low. A level over 120 before a meal is too high for some, while for others it is normal.

Time :	*Excellent*	*Good*	*Fair*	*Poor*
Before a Meal (or fasting)	60 - 100	100 - 140	140 - 180	over 180
After a Meal	110 - 140	140 - 180	180 - 220	over 220

Table 3.1 The guidelines for blood glucose level

3.4 RECORDING SELF MONITORING BLOOD GLUCOSE RESULTS

Keeping a record of self monitoring blood glucose test results is vital. We must make sure the test record includes any unusual events, such as illness, stress and changes in exercise or activity level.

The blood sugars can be read as low as 0 and as high as 600 mg. Results may be obtained in 20 seconds to 2 minutes. Some tests require blotting or wiping, while others do not. We use a light source with filters and a lens (Photometric – colour reflectance) to detect the colour change on a strip pad causes by glucose in the blood. A digital results is produced. Photometric meters include the accuchek, one touch, tracer, diascan and glucometer.

Glucose in the blood causes a reaction on the test strip that produces a tiny current. The meter detects the current and reports a digital test results.

3.5 GLYCOSYLATED HEMOGLOBIN

Glycosylated hemoglobin, or Hgb AIC, is a test that reflects the average of the blood sugar levels uver the past 2 to 3 months. Hemoglobin is a protein found inside red blood cells. Glucose binds to hemoglobin, causing it to become glycosylated. The higher the percentage of hemoglobin that is glycosylated, the higher your average blood sugar for the past 2 to 3 months.

3.6 KIDNEYS

The kidneys are bean-shaped organs, each about the size of a tightly clenched fist. They lie on the posterior abdominal wall behind the peritoneum and on either side of the vertebral column near the lateral borders of the psoas muscles. The superior pole of each kidney is protected by the rib cage, and the right kidney is slightly lower than the left because of the presence of the liver superior to it. Represent about 0.5% of the total weight of the body, but receive 20-25% of the total arterial blood pumped by the heart. Each contains from one to two millions nephrons. Each kidney measures about 11 cm long, 5 cm wide and 3 cm thick and weighs about 13 g. A fibrous connective tissue layer, called the renal capsule, encloses each kidney and around the renal capsule is a dense deposit of adipose tissue, the renal fat pad which protects the kidney from mechanical shock. The kidneys and surrounding adipose tissue are anchored to the abdominal wall by a thin layer of connective tissue, the renal fascia.

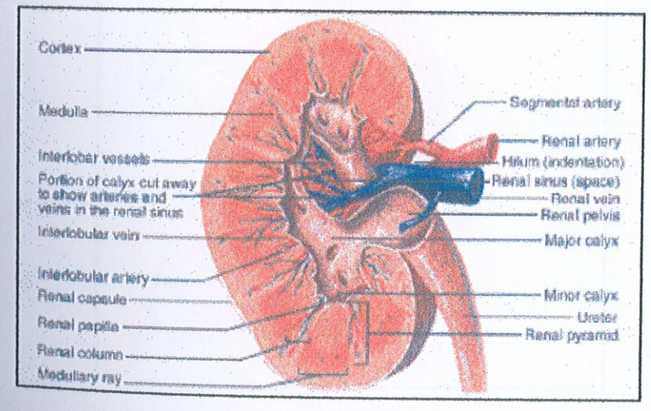


Figure 3.1 The structure of kidney

The outer portion of the kidney is the renal cortex. The medulla lies below the cortex; the many parallel tubes within it give it a striped appearance. The intermost portion is the renal pelvis, which collects the urine and passes it to the ureter. Each kidney lobe contains a large number of nephrons.

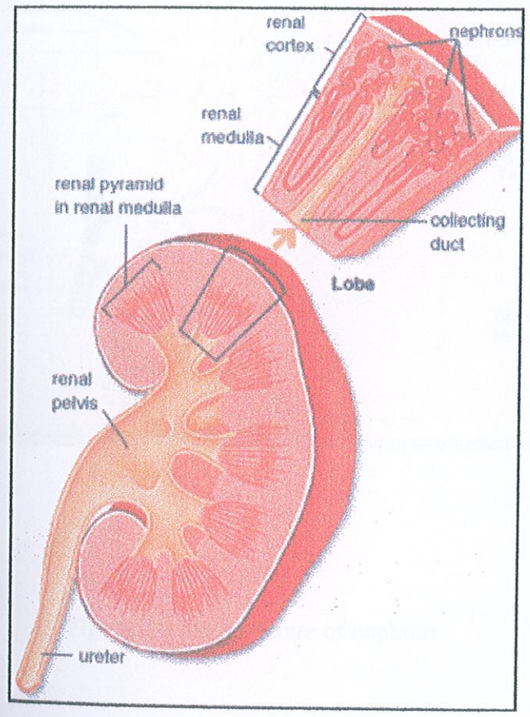


Figure 3.2 The outer portion of the kidney

This renal artery branches until each nephron has an afferent arteriole leading to it. This afferent arteriole leads to a convoluted capillary called the glomerulus. The efferent arteriole leads away from the glomerulus to a second capillary bed, the peritubular capillaries. Venous circulation leads away from the nephrons.

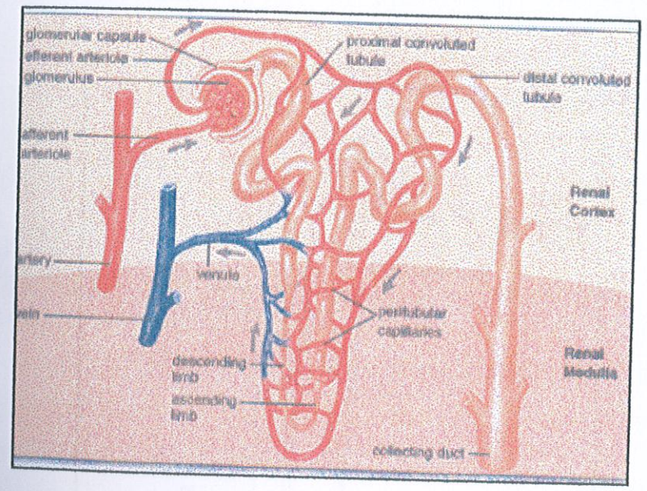


Figure 3.3 The structure of nephron

The nephron is the functional unit of the vertebrate kidney. Each human kidney has about one million of these tiny structures, each consisting of an initial filtering component called the renal corpuscle and a tubule that extends out from the renal corpuscle. Fluid filters from a glomerulus (the capillaries of the renal corpuscle) into the glomerular (Bowman's) capsule. It the flows into a proximal convoluted tubule, loop of Henle, distal convoluted tubule and collecting duct system (not shown). Several tubules combine to form the collecting ducts. Cells of the tubule wall process the material filtered from the blood, reabsorbing some subtances into the bloodstream and secreting others from the blood into the tubule.

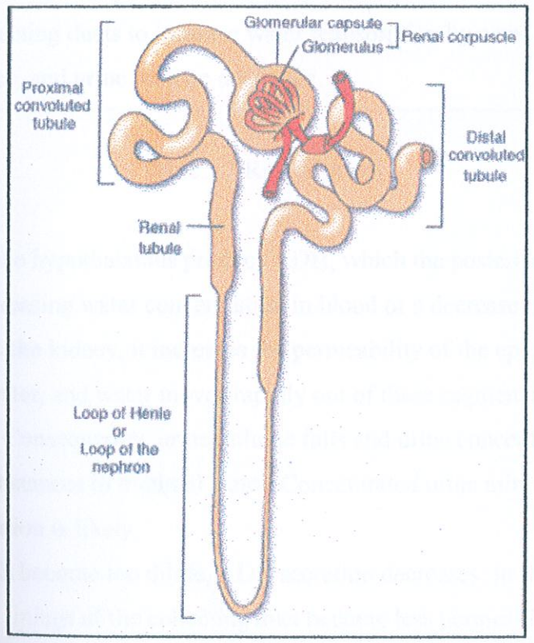


Figure 3.4 The functional of nephron

3.6.1 KIDNEY FUNCTION CONTROL

Role of ADH in Regulating Urine Concentration and Volume
1. Concentration of water in blood decreases.
2. Increases in osmotic pressure of body fluids stimulates osmoreceptors in hypothalamus in brain.
3. Hyphothalamus signals posterior pituitary to release ADH.
4. Blood carries ADH to kidneys.
5. ADH causes collecting ducts to increase water reabsorption by osmosis.
6. Urine concentrates, and urine volume decreases.

Table 3.2 Role of ADH

Neurons in the hypothalamus produce ADH, which the posterior pituitary releases in response to a decreasing water concentration in blood or a decrease in blood volume. When ADH reaches the kidney, it increases the permeability of the epithelial lings of the collecting duct to water, and water moves rapidly out of these segments by osmosis (water reabsorbed). Consequently, urine volume falls and urine concentrates soluble wastes and other substances in minimal water. Concentrated urine minimizes loss of water when dehydration is likely.

If body fluids become too dilute, ADH secretion decreases. In the absence of ADH, the epithelial linings of the collecting duct become less permeable to water, less water is reabsorbed, and urine is more dilute, excreting the excess water.

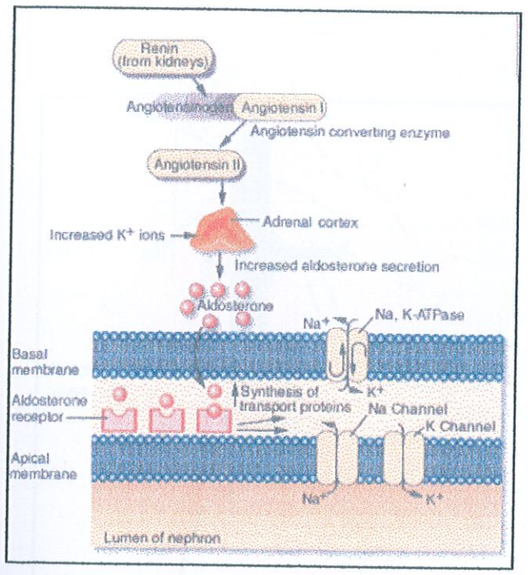


Figure 3.4 The effect of aldosterone on the cortical collecting dust

Effect of aldosterone on the cortical collecting dust. Aldosterone increases the rate at which sodium ions are absorbed and potassium ions are secreted.

3.7 URINARY SYSTEM

Blood enters the kidney in the renal artery, which is a branch off of the aorta. It leaves the kidney in the renal veins, which joins the inferior vena cava.

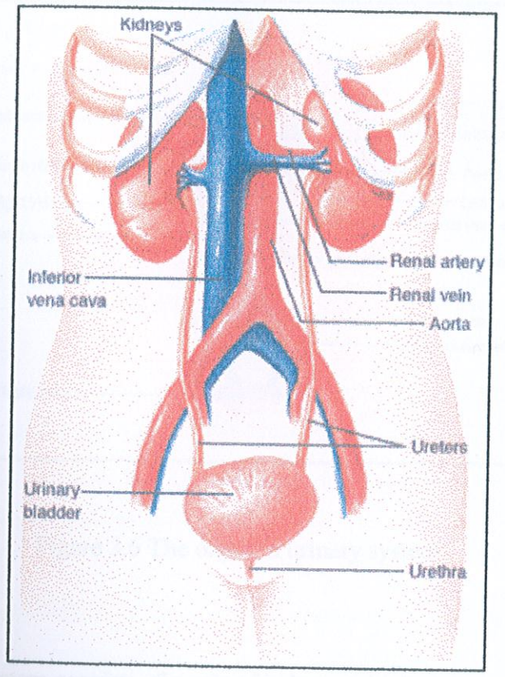


Figure 3.5 The urinary system

3.8 URINE TESTS

3.8.1 TESTING FOR URINE KETONES

When there is not enough insulin present to funnel glucose into cells, the human Body tries to use stored far to make fuel available to the cells. Fat in fat cells is broken down to "fatty acids", which pass through the liver and form ketones (acetone). Ketones are exhaled and excreted in urine.

Ketones in your urine is a warning sign of a low insulin level that requires quick action. The only exceptions are when the ketones have following an insulin reaction or if the blood glucose level is near normal.

3.8.2 URINE TEST RESULTS

The results of the urine test is a percentage figure that indicates the concentration of sugar in urine. The higher the figure, the higher the concentration of sugar. The test results will vary from one half % to 5%, depending on the concentration of sugar. We use the percentage value when recording test results.

When in good control, the urine tests should be negative (no sugar) most of the time. A negative urine test indicates that the blood glucose level is probably below 180 mg/ml.

3.9 URINE FORMATION

Because of constriction of the efferent arteriole, blood is under pressure in the glomerulus and water and other small molecules filter into glomerular capsule. This fluid is called filtrate and about 45 gallons are produced everyday. Most of the water and many other molecules are reabsorbed as the filtrate moves along the tubules. Some substances are secreted into the filtrate by active transport across tubule walls. Reabsorption and secretion occur in various sites.

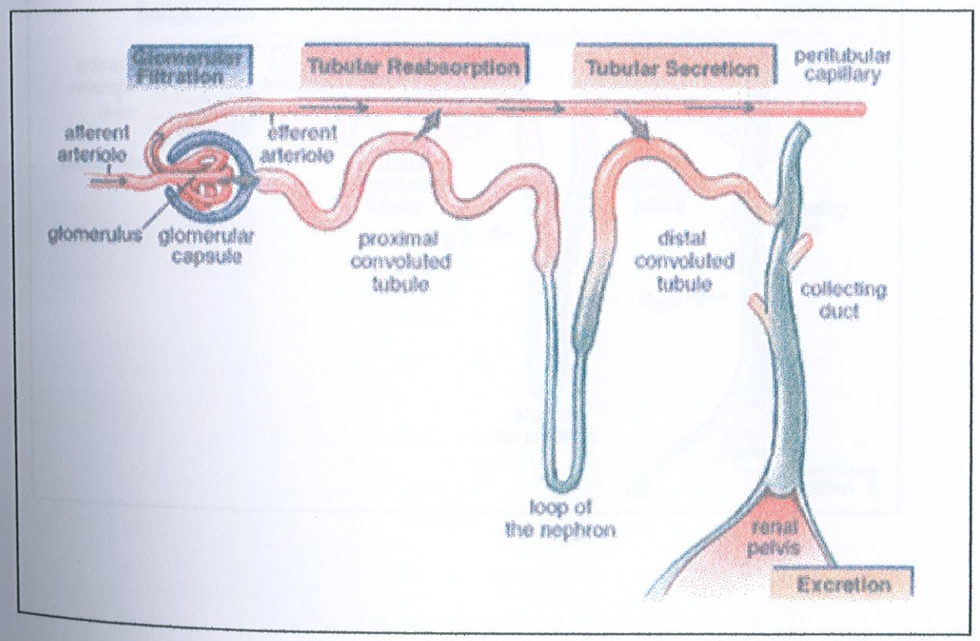


Figure 3.7 Urine formation

Although there are 45 gallons of filtrate produced daily, most of the water is reabsorbed, if not, we would quickly die of dehydrated. Most water reabsorption occurs in the proximal tubule, but the final conversation of water is largely due to the long loop of the nephron, which establishes a concentration gradient in the kidney tissue. Water can leave thecollecting duct by osmosis and return to the bloodstream in the surrounding peritubular capillaries.

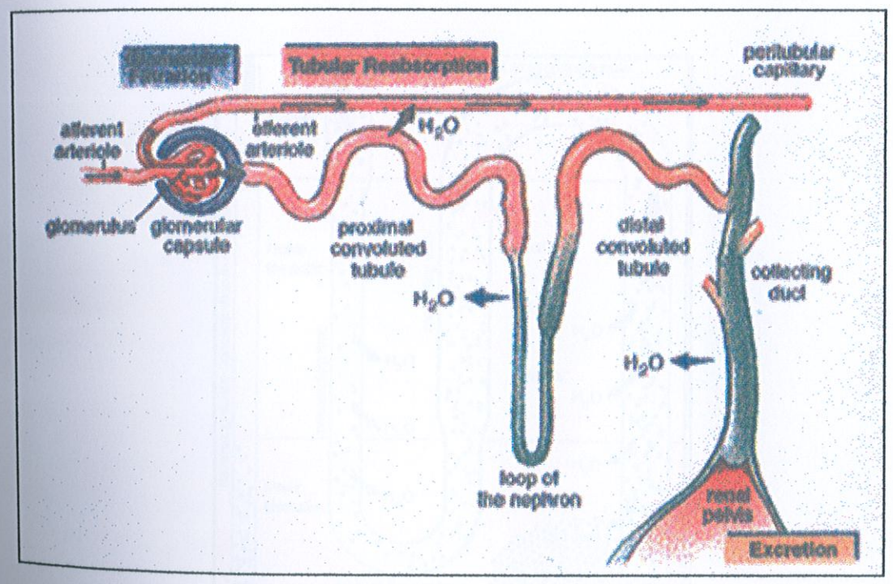


Figure 3.8 Water reabsorbed

Based to the figure below:

1. A concentration gradient is established in the kidney tissue.
2. The walls of the descending limb of the loop of the nephron are permeable to water, which leaves by osmosis.
3. Salt is transported out of the ascending limb, which is impermeable to water. This increase in the salt concentration of the surrounding tissue is the reason water is leaving the descending limb.
4. Water follows its concentration gradient out of the collecting duct.

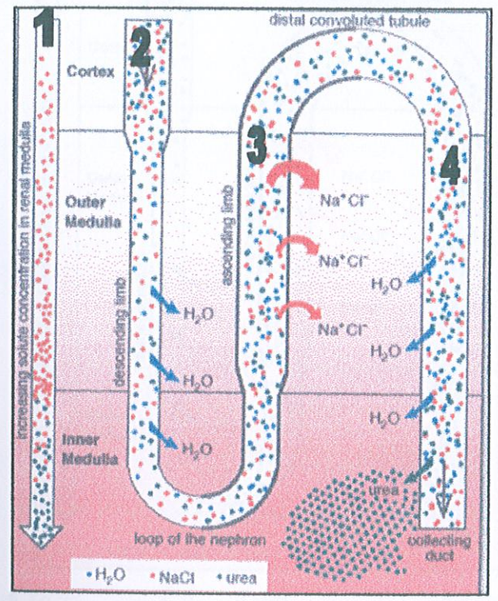


Figure 3.9 The role of urea in concentration

The permeability of the wall of the collecting duct varies under the influence of antidiuretic hormone, ADH. ADH is released by the posterior pituitary in response to increased osmosis pressure (decreased water or increased solutes in blood). Its effect is to increase the wall's permeability to water so that more water leaves the collecting duct and returns to the bloodstream. If osmotic pressure of the blood decreases, ADH is not released and water stays in the collecting duct, thus leaving in urine.

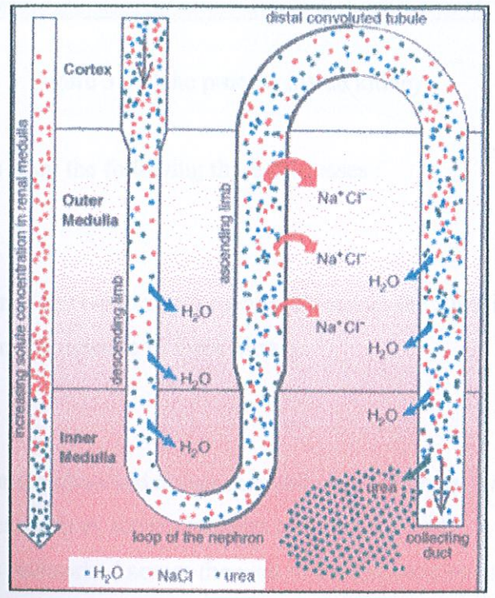


Figure 3.10 The osmolality of different regions of the kidney

3.9.1 URINE FORMATION RESULTS

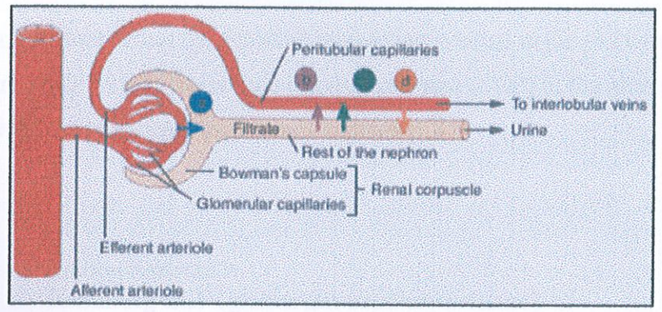


Figure 3.11 The process inside kidney

Urine formation results from the following three processes :

1. Filtration
   - Filtration is the movement of materials across the filtration into the lumen of Bowman's capsule to form filtrate.

2. Reabsorption
   - Solutes are reabsorbed across the wall of the nephron by transport processes, such as active transport and contransport.
   - Water is reabsorbed across the wall of the nephron by osmosis.

3. Secretion
   - Solutes are secreted across the wall of the nephron into the filtrate.

3.9.2 FILTRATION PRESSURE

Filtration pressure across the filtration membrane is equal to the glomerular capillary pressure (GCP) minus the colloid osmotic pressure (COP) in the glomerular capillary and minus the pressure in Bowman's capsule (CP).

Filtration Pressure =
60 mm Hg GCP (glomerular capillary pressure)
- 28 mm Hg COP (colloid osmotic pressure)
15 mm Hg CP (capsule pressure)
17 mm Hg filtration pressure

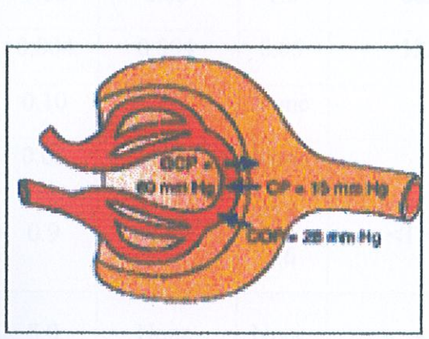


Figure 3.12 Bowman's capsule and glomerular capillaries

Composition of plasma, nephric filtrate, and urine (each in **g/100 ml** of fluid). These are representative values. The values for salts are especially variable, depending on salt and water intake.

Component	Plasma	Nephric Filtrate	Urine	Concentration	% Reclaimed
Urea	0.03	0.03	1.8	60X	50%
Uric acid	0.004	0.004	0.05	12X	91%
Glucose	0.10	0.10	None	-	100%
Amino acids	0.05	0.05	None	-	100%
Total inorganic salts	0.9	0.9	<0.9-3.6	<1-4X	99.5%
Proteins and other macromolecules	8.0	None	None	-	-

Table 3.3 Representative value of component in urine formation

3.9.3 Ph SCALE

The pH scale measures the concentration of hydrogen ions in a solution. The numbers on the scale refer to the exponent of the concentration of hydrogen ions. In solution with a pH of 3, one in every 10^3 molecules is a hydrogen ion. In a solution with a pH of 4, one in 10^4 molecules is a hydrogen ion (10 times less).

Between each number on the pH scale there is a 10X change in H^+ and OH^- concentration. Two steps represents a 100X change and three steps represents a 1000X xhange. Fluids in living things must be kept within a narrow range of pH for proper functioning of the enzymes involved in biochemical reactions. Buffering system are used to maintain pH.

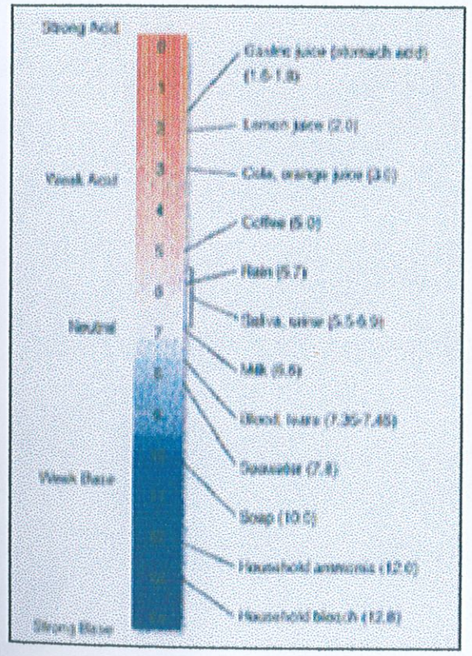


Figure 3.13 pH of the urine

CHAPTER 4

METHODOLOGHY

CHAPTER 4 : METHODOLOGHY

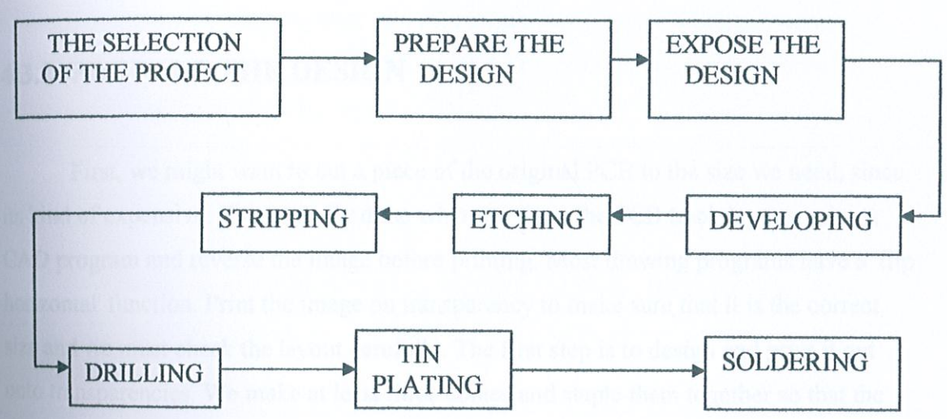
4.1 THE STEPS TO START A PROJECT

To start a project we must follow the steps to make sure the project will complete without any problem. This is because in the end of the project we can get a good result.

4.2 PRINTED CIRCUIT BOARD

Printed circuit boards (PCB's) are laminates. This means that they are made from two or more sheets of material stuck together; often copper and fibreglass. Unwanted areas of the copper are etched away to form conductive lands or tracks which replace the wires carrying the electric currents in other forms of construction. Some parts of the side with copper tracks is coated with solder resist (usually green in colour) to prevent solder sticking to those areas where it is not required. This avoids unwanted solder bridges between tracks. Sometimes the boards are double-sided with copper tracks on both sides. Tracks on one side can be joined to tracks on the other by means of wire links. Plated through holes are available which do the same thing but these make the PCB more expensive. Components are stuffed into the board by hand or by pick and place machines. Soldering is done by hand or by flow wave soldering where the PCB passes over a wave of molten solder. Most recent PCB's use surface mount techniques where components are on the same side of the board as the tracks. Components are stuck to the board with adhesive and the solder caused to flow by heating the board in a hot gas or by some other technique. When fitting components ensure that they are orientated correctly and lay flat on the board unless otherwise stated. When the board is assembled avoid flexing it which may crack tracks. Avoid touching the board which may cause contamination due to dirty fingers or damage due to static electricity carried on your body. It is best to handle PCB's by holding them by two edges only, between thumb and forefinger.

4.3 METHODOLOGY BLOCK DIAGRAM



4.3.1 THE SELECTION OF THE PROJECT

We were be given a time to think and decided our project. After a discussion with our group so we make a decision to make a 4 channel blood urine and glucose measurement system that it is our project now. This is our part of the step to start a project.

4.3.2 PREPARE THE DESIGN

First, we might want to cut a piece of the original PCB to the size we need, since its kind of expensive. This is easily done when we draw the PCB track layout, using a CAD program and reverse the image before printing. Most drawing programs have a 'flip horizontal' function. Print the image on transparency to make sure that it is the correct size and we must check the layout carefully. The first step is to design and print it out onto transparencies. We make at least three copies and staple them together so that the design lines up. This is to make sure that during exposure under the UV lamp the light does not expose the design itself and ruin the design. The design must fit in the exposure bracket with the entire of the design under the glass. It is better to have a smaller board than a larger one, as it reduces etching time.

Once we have the image transferred, it is important to look over the board and make sure we transferred the entire circuit well. Otherwise, we'll end up etching more than we wanted. It is therefore useful to use a permanent marker to go over any problem areas. We're ready for etching once we have an image on the copper that we're content with. Care must be taken to ensure the circuit layout will be to scale and won't be too big to fit on the sheet. The layer to be printed out must be defined and pad holes must be set to 'Avoid' so as black dots and not rings are printed to indicate holes to be drilled.

4.3.3 EXPOSE THE DESIGN

Set the transparencies with the design on them in the center of the board. Place the whole thing under the UV lamp and turn on the lamp. Leave about 5 minutes for the lamp to warm up and then another 3 minutes to fully expose the design. At this point, the lights in the dark room should turn off and the door must be close. We must work by the light of incandescent bulbs only, and do not shine the incandescent light directly on the PC board. Leaving the fluorescent lights on will expose the pattern of the PC board.

4.3.4 DEVELOPING

As we reach the end of the exposure time, we mix up the developing solution. The bottle of developing chemical need to be diluted approximately 10:1 water. We need to make enough solution as to cover the design. In any case, it is best make the solution slightly more dilute than 10:1 rather than the other way and using the lukewarm waters helps the development. Once the solution is made (we must make sure that it's well mixed) and pour the solution into the tray and place the exposed PCB into the solution. We must make sure that we do not pour the solution over the PC board. This will completely erase the design. Now we must slowly swirl the developer over the board and watch for the design to appear. There will not be a color change or anything, but will be able to see the design faintly on the board. Once you can see the design, or at least its majority, remove the board and immediately rinse it in warm water. The important things is do not develop for more than 1.5-2 minutes. If the design can not been seen at this point, most likely it will miss and the developer erased it.

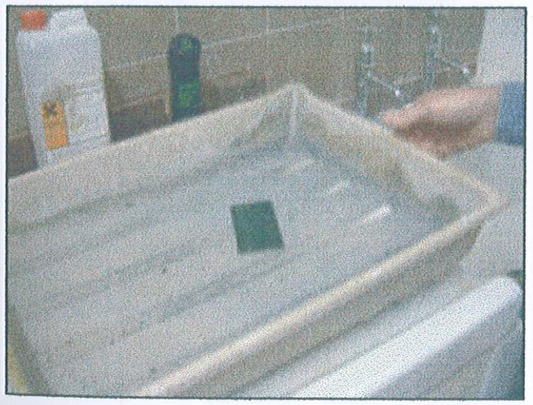


Figure 4.1 The developing process at the Printed Circuit Board

4.3.5 ETCHING

At this point, the PC board must place into a tray and put the container on a hot plate. About 1 teaspoon/25 ml of water is usually adequate. Heat this solution to near boiling in a glass container slightly larger than the board to be etched. Drop in the board, close the lid and submerge the bottle slightly in hot water to keep it warm. The reaction is faster at warmer temperatures. Something like 50-80 degrees C will work. Etching time will vary, though 30-45 minutes is about average. In any case, we used latex or vinyl gloves to avoid skin contact with the etchant. Leave the board in the etchant until the clarity of the design is satisfactory, and then remove it from the FeCl3 and rinse it off with water. Both the used FeCl3 and the developer can go down the sink so long as you use lots of water as well. Afterwards, the board can be rinsed, dried and drilled.

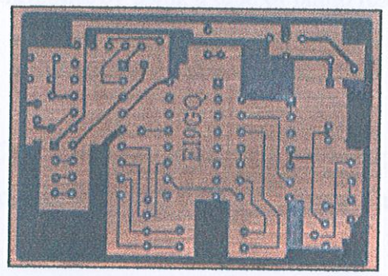


Figure 4.2 Printed Circuit Board before etching

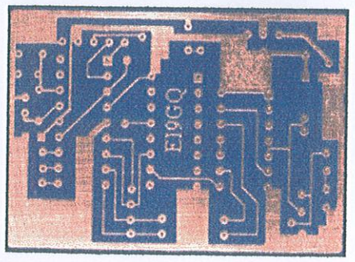


Figure 4.3 Printed Circuit Board after etching

4.3.6 STRIPPING (OPTIONAL)

After etching the positive resist 9 (photo-resist) maybe left on the copper to act as protection. Solder is readily achieved through the resist. This green photo-resist can be removed using a tube of photo resist stripper, (like shoe polish) and the PCB washed clean under tap water and dried using tissue paper.

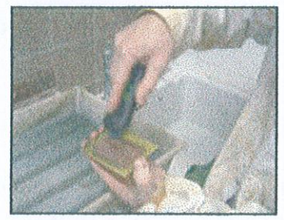


Figure 4.4 Stripping by using a tube of photo resist stripper

4.3.7 DRILLING

After cutting the PCB to size around the perimeter using the guillotine, drilling using a 0.9-mm drill can now be performed in the workshop. The board is now ready to stuff with components.

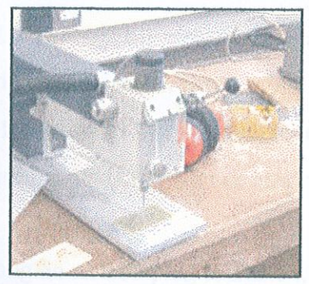


Figure 4.5 Drilling using a drill

4.3.8 TIN-PLATING

This is done to provide a nice finish and to protect the copper from oxidization; also soldering will appear neater and will flow better. A solution made up of fine tin powder mixed with water is poured into a basin. The copper is cleaned to a shiny finish be rubbing using a rubber supplied with the kit. The board is placed in the solution for 10 minutes. The board should then have a silver finish.

4.3.9 SOLDERING

The soldering process involves a metal-solvent action that joins two metals by dissolving a small amount of the metals at their point of contact. Use a good soldering iron with fine pencil tip. It is important to have a clean tip. Do not use very abrasive surfaces to clean or polish the soldering iron tip. If the tip looks bent or damaged, it is worth investing in a new tip.

While using soldering irons we must take precautions about the thing below :

- Solder on a fire resistant surface. Homosote, or dry wall are good.
- Never leave the iron plugged in and unattended.
- Do not overload a wall outlet with too many electric appliances.
- Never set the hot iron down on anything other than an iron stand.
- Replace the cord of the iron if it becomes worn or gets burnt.
- To prevent burning fingers, use needle nose pliers or heat resistant gloves to hold small pieces.
- Never cut off a grounding prong on an iron plug to make it fit an ungrounded receptacle.

As the solder interacts with the base metals, a good metallurgical bond is obtained and metallic continuity is established. This continuity is good for electrical and heat conductivity as well as for strength. Solder ability measures the ease with which molten solder wets the surfaces of the metals being joined. Wetting means the molten solder leaves a continuous permanent film on the metal surface. Wetting can only be done properly on a clean surface. All dirt and grease must be removed and no oxide layer must exist on the metal surface. Using abrasives and/or flux to remove these contaminants produces highly solder able surfaces.

The soldering process requires sufficient heat to produce alloy or metal solvent action. Heat sources include conductive, resistive, convective, and radiant types. The type of heat source most commonly used is the conductive-type soldering iron. Delicate electronic assemblies require that the thermal characteristics of a soldering iron be carefully balanced and that the iron and tip be properly matched to the job. Successful soldering depends on the combination of the iron tip temperature, the capacity of the iron to sustain temperature, the time of iron contact with the joint, and the relative mass and heat transfer characteristics of the object being soldered.

The amount of heat and how it is controlled are critical factors to the soldering process. The tip of the soldering iron transfers heat from the iron to the work. The shape and size of the tip are mainly determined by the type of work to be performed. The tip size and the wattage of the element must be capable of rapidly heating the mass to the melting temperature of solder.

After the proper tip is selected and attached to the iron, the operator may control the heat by using the variable-voltage control. The most efficient soldering temperature is approximately 550 degrees Fahrenheit. Ideally, the joint should be brought to this temperature rapidly and held there for a short period of time. In most cases the soldering action should be completed within 2 or 3 seconds. When soldering a small-mass connection, control the heat by decreasing the size of the tip.

Before heat is applied to solder the joint, a thermal shunt is attached to sensitive component leads (diodes, transistors, and ICs). A thermal shunt is used to conduct heat away from the component. Because of its large heat content and high thermal conductivity, copper is usually used to make thermal shunts. Aluminum also has good conductivity but a smaller heat content; it is also used to conduct heat, especially if damage from the physical weight of the clamp is possible. Many types, shapes, and sizes of thermal shunts are available. The most commonly used is the clamp design; this is a spring clip (similar to an alligator clip) that easily fastens onto the part lead, as shown in figure below.

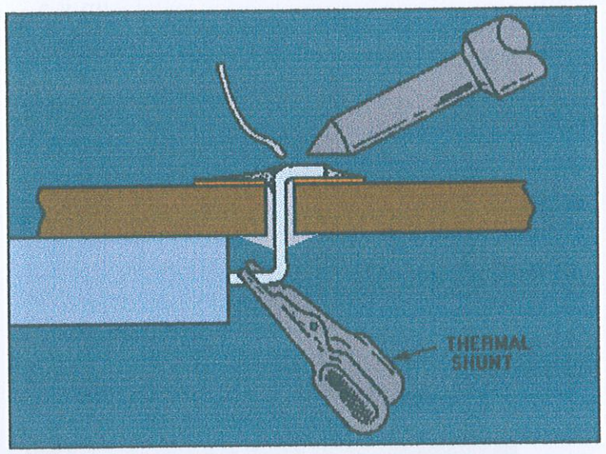


Figure 4.6 Thermal stunt is using for a good soldering

Before solder is applied to the joint, the surface temperature of the parts being soldered is increased above the solder melting point. In general, the soldering iron is applied to the point of greatest mass at the connection. This increases the heat in the parts to be soldered. Solder is then applied to a clean, fluxed, and properly heated surface. When properly applied, the solder melts and flows without direct contact with the heat source and provides a smooth, even surface that feathers to a thin edge.

Molten solder forms between the tip and the joint, creating a heat bridge or thermal linkage. This heat bridge causes the tip to become part of the joint and allows rapid heat transfer. A solder (heat) bridge is formed by melting a small amount of solder at the junction of the tip and the mass being soldered as the iron is applied. After the tip makes contact with the lead and the pad and after the heat bridge is established, the solder is applied with a wiping motion to form the solder bond. The completed solder joint should be bright and shiny in appearance. It should have no cracks or pits, and the solder should cover the pad. Examples of preferred solder joints are shown in figure below. They are referred to as full fillet joints.

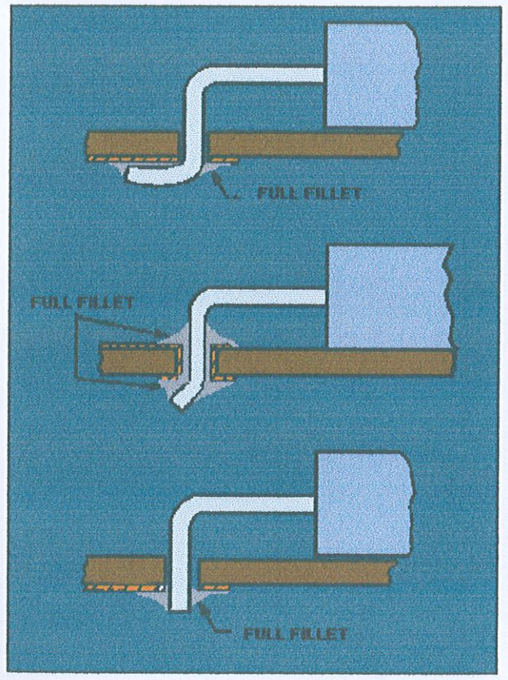


Figure 4.7 The examples of preferred solder joints

CHAPTER 5

PROJECT ANALYSIS

5.1 INTRODUCTION ABOUT ANALYSIS

Generally, for the whole project we get from many sources. For the main part in our project such as stepper motor and sensor we request and ask for help from our technician because it is very expensive. Furthermore, those features are very difficult to find in the market.

Other materials such as amplifier, ADC, PCB board and other things we try to prepare by ourselves by using the available materials from the lab in polytechnic. For library sources, please refer to the references section in this report. Beside that, we also get source from electronic shops.

This product used a Stepper motor with a specific function that means move clockwise, and stops at 4 axis. At the stepper motor we put the specimen which it is to receive and transmit. From here infra red sensor will detect to the specimen.

After that it will go to the second sensor and second sensor will detect to the pH paper. And then go to amplifier to amplify signal from the sensor and to the analogue digital (ADC). From here it will connect to the computer. Lastly the result will out in digital form. The product is designed and constructed as a PCB board. This project also using only 6 circuits and using interfacing.

Besides that, it enables fast, easy using new technology, which is more reliable and can give information with more exactly. All process will control by computer .

5.2 FUNCTION OF THE PIC

The input to the UCN 5804 are compatible with CMOS and TTL, meaning that we can connect the input from our PIC microcontroller directly to the UCN 5804 and expect it to function properly. The step input (pin 11) to the UCN 5804 is generated by the PIC microcontroller. The output enable pin enables the stepper motor when held low and disables (stops) the stepper motor when brought high.

Pins 10 and 14 on the UCN 5804 are controlled by switches that bring the pins to a logic high or low. Pin 10 controls whether the output to the stepper motor will be full step or half step and pin 14 controls direction. If we want, these options may also be put under the control of the PIC. The pins are brought to logic high and low to activate the options in the same way as the output enable pin was activated.

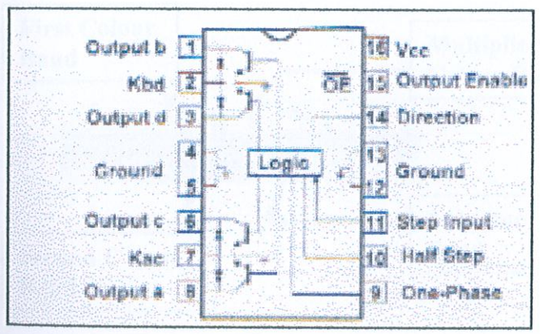


Figure 5.1 Pin out of the UCN 5804

5.3 COMPONENT INFORMATION

5.3.1 RESISTOR

Resistor are colour coded for easy reading. To determine the value of a given resistor it must look for the gold or silver tolerance band and rotate the resistor as it shown in the photo below. Based to the picture the tolerance band to the right. The first colour band and determine the colours. This maybe difficult on small or oddly coloured resistors. So that, we must look at the chart and match the "first and second colour band" colour to the "Digit it represents". The second colour band also have to match that colour to the same chart. The last colour band is the number that must multiply the result by. Match the third colour band with the chart under multiplier. This is the number that have to multiple the other 2 numbers by.

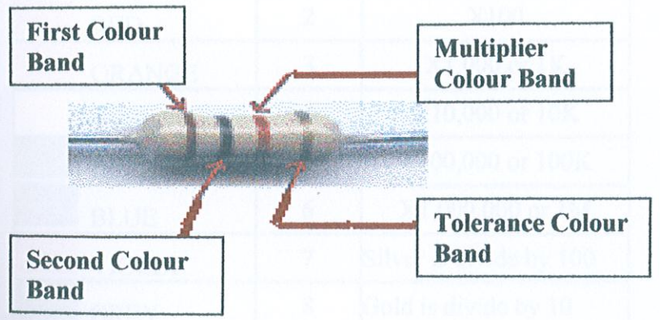


Figure 5.2 Resistor colour code

Resistor are never the exact value that the colour codes indicate. Therefore manufacturers place a tolerance colour band on the resistor to tell how the accurate this resistor is made. It is simply a measurement of the imperfections. Gold means the resistor is within 5% of being that dead on accurate. Silver being within 10% and no colour band being within 20%. To determine the exact range that the resistor may be, we must take the value of the resistor and multiply it by 5, 10 or20%. That is the number that the resistor may go either way.

COLOUR	1ST & 2ND BAND	MULTIPLIER
BLACK	0	X1
BROWN	1	X10
RED	2	X100
ORANGE	3	X1,000 or 1K
YELLOW	4	X10,000 or 10K
GREEN	5	X100,000 or 100K
BLUE	6	X1,000,000 or 1M
VIOLET	7	Silver is divide by 100
GREY	8	Gold is divide by 10
WHITE	9	• Tolerances • Gold = 5% • Silver = 10% • None = 20%

Table 5.1 Resistor colour code chart

Resistor is the one of the important electronic component. It is a device that resists the passage of an electric current and it can limit the current or less the voltage. If a large current flow in a resistor, it can produced heat which we can calculate by using formula IR. The unit of the resistor is Ohm (Ω). We can get resistor in many design and it have the same function and use. It can be classified depend to the use, the resist level and also the material to make the resistor. The normal disable resistor is because it being burnt as it can't handle the over flow of the current that through the resistor.

Figure 5.3 The symbol of resistor

5.3.2 CAPACITORS

Capacitors or "caps", vary in size and shape. From a small surface mount model up to a huge electric motor cap the size of a point can. Whatever the size or shape, the purpose is the same. It stores electrical energy in the form of electrostatic charge. The size of a capacitor generally determines how much charge it can store. A small surface mount on ceramic cap will only hold a minuscule charge. A cylindrical electrolytic cap will store a much larger charge. Some of the large electrolytic caps can store enough charge.

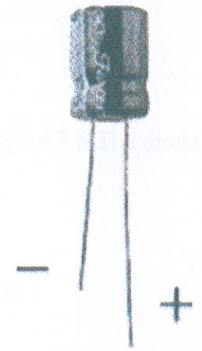


Figure 5.4 Capacitor

Figure 5.5 The symbol of capacitor

5.3.3 DIODES

Diodes are basically a one way value for electrical current. Flow in one direction from positive to negative and not in the other direction. Most diodes are similar in appearance to a resistor and will have a painted line on one end showing the direction of flow (white side is negative). If the negative side is on the negative end of the circuit, current will flow. If the negative is on the positive side of the circuit no current will flow.

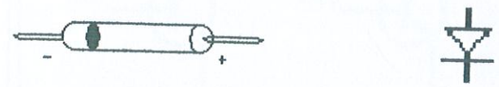


Figure 5.6 The diode symbol

There is a lots of diod type such as :

a) Diod Power - to protect component and change ac power to dc power.
b) Diod Signal - as a signal filter with high frekuensi in radio and television circuit.
c) LED - as a mark in circuit.

Figure 5.7 LED and symbol

5.3.4 TRANSISTOR

It is a component that made from semiconductor like silicon and germanium. It is a semiconductor device with three connections that able to amplify or rectify an electric current. It was built in P and N material. Each layer have its own terminal such as base, emitter and collector.

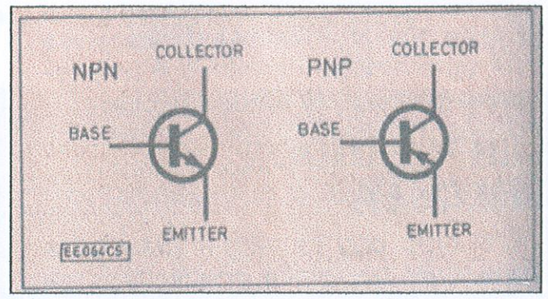


Figure 5.8 Symbol for transistor

5.3.5 IC (INTEGRATED CIRCUIT)

IC is a component with a compact circuit and made at a piece of special board. It can hold others small circuit such as transistor, diod, resistor and small capacitor. Each IC has its own pin and each pin have its own number. Circle mark at the top of it is a introduction to the pin which is the nearest pin to it is number one. The number of active component that less than 50 in a circuit is call small scalar IC. If the number of active component more than 50 then it is call large scalar.

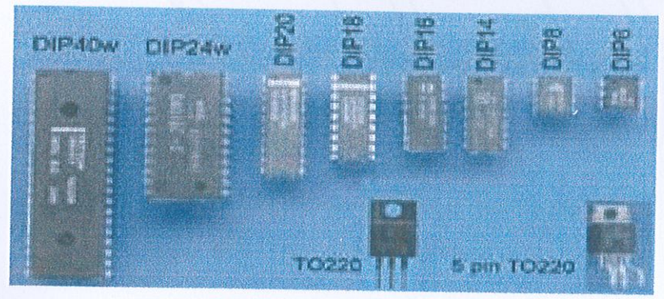


Figure 5.9 The example of IC

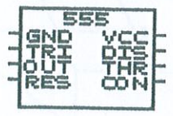


Figure 5.10 The symbol of IC

5.4 THE DESIGN OF THE PROJECT

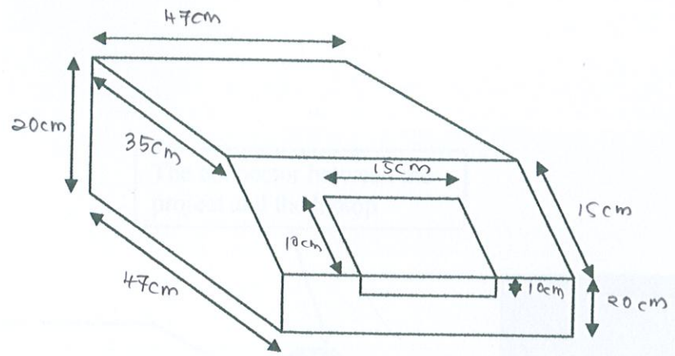


Figure 5.11 The size of the project casing

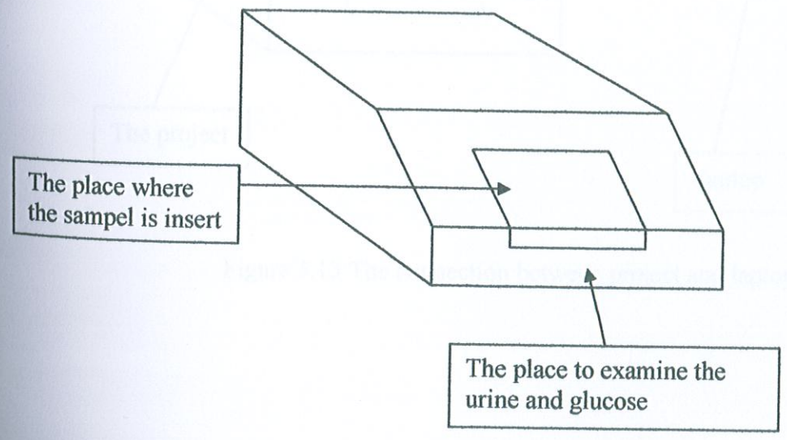


Figure 5.12 Instruction of the use of each part

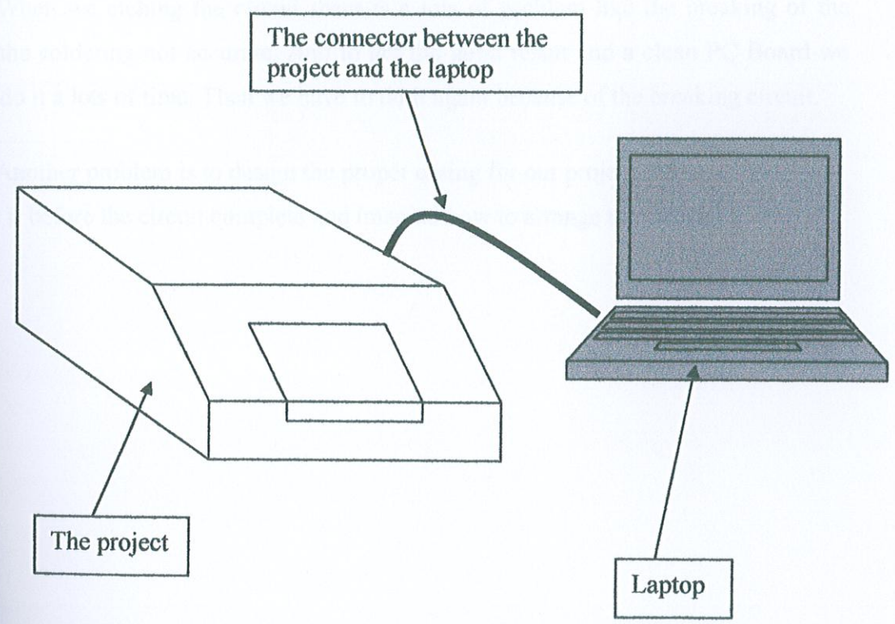


Figure 5.13 The connection between project and laptop

5.5 THE PROJECT PROBLEMS

While we completing the project we have facing a problems such as the circuit problem where we have to do the board again. The other problems that we handle is the stepper motor not function. This is because there is no power supply through it. After we troubleshoot it with our lecturer and friend then we know that the component damaged.

When we etching the circuit there is a lots of problem like the breaking of the circuit, the soldering not accurate. And to get the good result and a clean PC Board we have to do it a lots of time. Then we have to do it again because of the breaking circuit.

Another problem is to design the proper casing for our project. We have to imagine it before the circuit complete and imagine how to arrange the circuit inside the casing.

CHAPTER 6

MICROSOFT VISUAL BASIC

6.1 INTRODUCTION

Microsoft Visual Basic, the fastest and easiest way to create applications for Microsoft Windows. Whether an experienced professional or brand new to Windows programming, Visual Basic provides with a complete set of tools to simplify rapid application development.

So what is Visual Basic? The "Visual" part refers to the method used to create the graphical user interface (GUI). Rather than writing numerous lines of code to describe the appearance and location of interface elements, you simply add prebuilt objects into place on screen. If you've ever used a drawing program such as Paint, you already have most of the skills necessary to create an effective user interface.

The "Basic" part refers to the BASIC (Beginners All-Purpose Symbolic Instruction Code) language, a language used by more programmers than any other language in the history of computing. Visual Basic has evolved from the original BASIC language and now contains several hundred statements, functions, and keywords, many of which relate directly to the Windows GUI. Beginners can create useful applications by learning just a few of the keywords, yet the power of the language allows professionals to accomplish anything that can be accomplished using any other Windows programming language.

The Visual Basic programming language is not unique to Visual Basic. The Visual Basic programming system, Applications Edition included in Microsoft Excel, Microsoft Access, and many other Windows applications uses the same language. The Visual Basic Scripting Edition (VBScript) is a widely used scripting language and a subset of the Visual Basic language. The investment you make in learning Visual Basic will carry over to these other areas. Visual Basic has the tools such as:

- Data access features allow to create databases, front-end applications, and scalable server-side components for most popular database formats, including Microsoft SQL Server and other enterprise-level databases.
- ActiveX technologies allow us to use the functionality provided by other applications, such as Microsoft Word word processor, Microsoft Excel spreadsheet, and other Windows applications. We can even automate applications and objects created using the Professional or Enterprise editions of Visual Basic.

6.2 THE STRUCTURE OF A VISUAL BASIC APPLICATION

An application is really nothing more than a set of instructions directing the computer to perform a task or tasks. The structure of an application is the way in which the instructions are organized; that is, where the instructions are stored and the order in which instructions are executed.

Simple applications such as the classic "hello world" example have a simple structure; organization isn't very important with a single line of code. As applications become more complex, the need for organization or structure becomes obvious. Imagine the chaos that would result if your application's code was allowed to execute in random order. In addition to controlling the execution of an application, the structure is important to the programmer: how easily can you find specific instructions within your application?

Because a Visual Basic application is based on objects, the structure of its code closely models its physical representation on screen. By definition, objects contain data and code. The form that you see on screen is a representation of the properties that define its appearance and intrinsic behavior. For each form in an application, there is a related *form module* (with file name extension .frm) that contains its code.

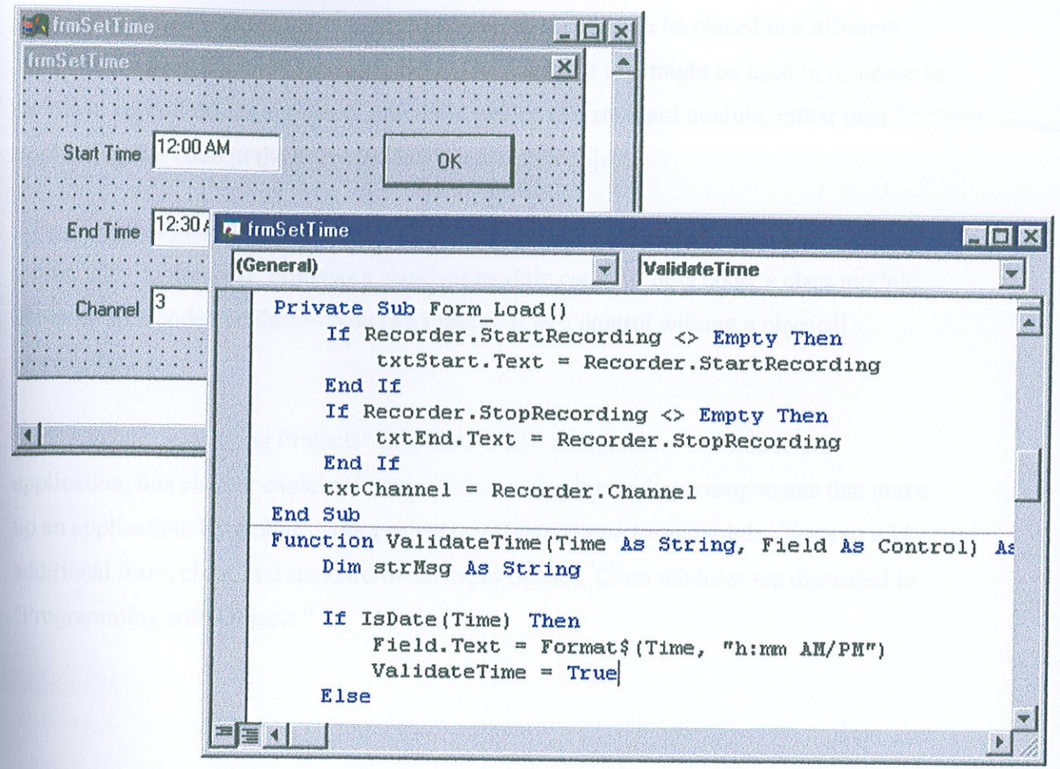


Figure 6.1 The example of Visual Basic framework

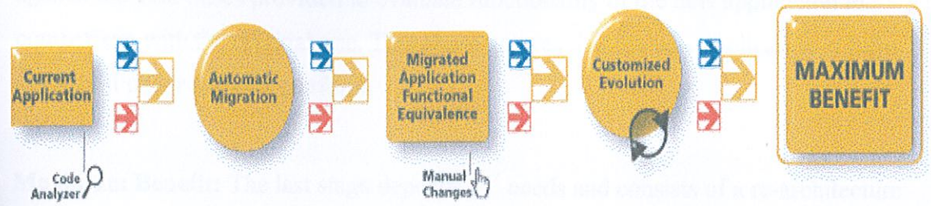
Each form module contains *event procedures* — sections of code where you the instructions can be placed and will execute in response to specific events. Forms can contain controls. For each control on a form, there is a corresponding set of event procedures in the form module. In addition to event procedures, form modules can contain general procedures that are executed in response to a call from any event procedure.

Code that isn't related to a specific form or control can be placed in a different type of module, a *standard module* (.BAS). A procedure that might be used in response to events in several different objects should be placed in a standard module, rather than duplicating the code in the event procedures for each object.

A *class module* (.CLS) is used to create objects that can be called from procedures within your application. Whereas a standard module contains only code, a class module contains both code and data — you can think of it as a control without a physical representation.

While "Managing Projects" describes which components can add to an application, this chapter explains how to write code in the various components that make up an application. By default, your project contains a single form module. You can add additional form, class, and standard modules, as needed. Class modules are discussed in "Programming with Objects."

6.3 SYSTEM FRAMEWORK



Current Application: To have a thorough analysis of the application, we use the Code Analyzer to analyze the application. The analysis then continues with an evaluation of needs together with their current application, and determines: first, the estimated cost and time of the total project and second, the different phases that the process has to go through in order to reach the maximum utilization state of .NET environment.

In some cases, the application goes through a "preliminary" migration. This allows to "tweak" the application so that it migrates with ease and few errors.

Automatic Migration: The use of the conversion tool, the Upgrade Wizard, is the second step in the process

Migration Application: Once the previous stage is complete, the code with no correspondence on .NET has to be rewritten in order to reach "Functional Equivalence. Functional Equivalence means that the recently migrated application now has the same functionality as the original application, but with the added advantage of being on .NET.

- **Customized Evolution:** In the second to last stage, the converted application is tested against the Test Cases provided to evaluate functionality of the new application in comparison with the original one. This phase assures that the new application is fully functional under the new platform.

- **Maximum Benefit:** The last stage depends on needs and consists of a re-architecture of the application to take advantage of the features of the new technology. At this time, the application can reap the benefits of the new platform and reach the maximum utilization state of .NET environment, such as being web enabled (using WinFormsToWeb), switching to ADO.NET or utilizing XML.

6.4 SYSTEM REQUIREMENT FOR VISUAL BASIC APPLICATIONS

The following hardware and software is required for Visual Basic applications:

- Pentium® 90MHz or higher microprocessor.
- VGA 640x480 or higher-resolution screen supported by Microsoft Windows.
- Microsoft Windows NT 4.0 or later, or Microsoft Windows 95 or later.
- 24 MB RAM for Windows 95/98, 32 MB for Windows NT.
- Microsoft Internet Explorer version 4.01 or later (version 4.01 Service Pack 1 or later for DHTML application developers, and 4.*x* for end-users of these applications).
- Disk space requirements:
  - Standard Edition: typical installation 48 MB, full installation 80 MB.
  - Professional Edition: typical installation 48 MB, full installation 80 MB.
  - Enterprise Edition: typical installation 128 MB, full installation 147 MB.
  - Additional components (if required): MSDN (for documentation): 67 MB, Internet Explorer 4.x: approximately 66 MB.
- CD-ROM (no MS-DOS support assumed).

6.5 FORMS, CONTROLS AND MENUS

The first step to creating an application with Visual Basic is to create the interface, the visual part of the application with which the user will interact. Forms and controls are the basic building blocks used to create the interface; they are the objects that you will work with to build your application.

Forms are objects that expose properties which define their appearance, methods which define their behavior, and events which define their interaction with the user. By setting the properties of the form and writing Visual Basic code to respond to its events, that we customize the object to meet the requirements of our application.

Controls are objects that are contained within form objects. Each type of control has its own set of properties, methods and events that make it suitable for a particular purpose. Some of the controls we can use in our applications are best suited for entering or displaying text. Other controls let we access other applications and process data as if the remote application was part of the code.

6.6 PROJECT LIMITATIONS

A single project can contain up to 32,000 "identifiers" (any nonreserved keyword), which include, but are not limited to, forms, controls, modules, variables, constants, procedures, functions, and objects. Note that the actual number of identifiers is limited to available memory.

Variable names in Visual Basic can be no longer than 255 characters, and the names of forms, controls, modules, and classes cannot be longer than 40 characters. Visual Basic imposes no limit on the actual number of distinct objects in a project.

6.7 CONTROL LIMITATIONS

Each nongraphical control (all the controls except shape, line, image, and label) uses a window. Each window uses system resources, limiting the total number of windows that can exist at one time. The exact limit depends on the available system resources and the type of controls used.

To reduce consumption of system resources, use the shape, line, label, and image controls instead of picture box controls to create or display graphics.

6.7.1 TOTAL NUMBER OF CONTROLS

The maximum number of controls allowed on a single form depends on the type of controls used and available system resources. However, there is a fixed limit of 254 control names per form. A control array counts only once toward this limit because all the controls in the array share a single control name.The limit on control array indexes is 0 to 32,767 on all versions.Visual Basic will generally accept no more than 25 levels of nested controls.

6.7.2 LIMITATIONS FOR PARTICULAR CONTROLS

The following table lists property limitations that apply to particular controls in Visual Basic.

Property	Applies to	Limitation
List and ListCount	List box and combo box controls	Maximum number of items is 32K; the limit on the size of each item is 1K (1024 bytes).
Text	Text box control	Limited to 64K.
Caption	Label control	Limited to 1024 bytes.
	Command button, check box, frame, and option button controls	Limited to 255 characters. Any caption over these limits is truncated. Captions on custom control properties are limited to 32K.
	Menu control	Limited to 235 characters.
Tag	All controls	Limited only by available memory.
Name	All controls	Limited to 40 characters.

Table 6.1 Limitation for particular controls

Note In Visual Basic, control property names are limited to 30 characters.

CHAPTER 7

CONCLUSION

7.1 CONCLUSION

In this project we do research about this 4 channel blood urine and glucose measurement system. Before this we do not know about this measurement system. We also know the function of each circuit.

Moreover this project also help student to expose themselves working in group with co-operation, a part of their way to be a moral person. Relationship with lecturer and the person who help us in this research also can help we to be more motivated in handling a responsibility given to them and even a student like us can regain ourselves confidence in handling a difficult situation.

The most important part of a project is that the student understand the concepts of each circuit and involved then is able to explain what happens, how it happens, why it happen. And also if the project doesn't work while it has to show to the lecturer we must know and can explain why it failed then actually we have learned something. And learning is what it's all about.

CHAPTER 8

COMMENT AND SUGGESTION

8.1 COMMENT

We would like to give a comment as result for a good thing is incoming student in next time. The comments are :

1. We were very happy and proud because we can finish this project report for this semester and made it in English Language although this is our first time.
2. We need more guidelines and information and some sample about our project in medical laboratory.
3. The schedule of project subject is not so long. So that we can't do more discussion with the lecturer and group members.

8.2 SUGGESTION

Other than that, we would like also give some suggestion about this project subject and our project :

1. A good preparing of syllabus that introduce student with more and many information about medical course especially fot the equipment.
2. We hope that the students can get the priority to choose their project and it must relate with their course.
3. Student must always meet their lecturer when they have a problem with their project.
4. Student should involved any activities that related with their project.

REFERRENCES

1. Project coordinator:
    a. Mr. Zunuwanas Mohamad
    b. Mr. Abu Bakar Hafis
    c. Miss Wee Soo Lee

2. Technician from University Kebangsaan Malaysia Hospital.

3. Web sites:
    a. www. Boondog.com / tutorials / irled / ir.html
    b. www. Ti. com
    c. www.yahoo.com
    d. www. mhhe.com / fox /

4. Human Physiology Book by McGraw Hill.

5. The British Multimedia Encylopedia.

APPENDIX

```
Private Sub chkBold_Click ()
   If ChkBold.Value = vbChecked Then    ' If checked.
      txtDisplay.Font.Bold = True
   Else                                 ' If not checked.
      txtDisplay.Font.Bold = False
   End If
End Sub

Private Sub chkItalic_Click ()
   If ChkItalic.Value = vbChecked Then    ' If checked.
      txtDisplay.Font.Italic = True
   Else                                   ' If not checked.
      txtDisplay.Font.Italic = False
   End If
End Sub
Private Sub opt586_Click()
   strComputer = "Pentium"
   Call DisplayCaption
End Sub
Sub DisplayCaption()
   lblDisplay.Caption = " a " & _
   strComputer & " running " & strSystem
End Sub
```

```
'Stepper motor controler
Symbol TRISB = 134              'Initialize TRISB to 134
Symbol PortB = 6                'Initialize variable PortB to 6
Symbol ti  = b6                 'Initialize ti delay
ti = 25                         'Set delay to 25 ms
Poke TRISB, 0                   'Set port B lines output
start:                          'Forward rotation sequence
Poke portB,1                    'Step 1
Pause ti                        'Delay
Poke portB,2                    'Step 2
Pause ti                        'Delay
Poke portB,4                    'Step 3
Pause ti                        'Delay
Poke portB,8                    'Step 4
Pause ti                        'Delay
Go to start                     'Do it again
```

```
'Stepper motor controller
Symbol TRISB = 134              'Initialize TRISB to 134
Symbol TRISA = 133              'Initialize TRISA to 133
Symbol portB = 6                'Initialize variable portB to 6
Symbol portA = 5                'Initialize variable portA to 5
Symbol ti = b6                  'Initialize ti delay
ti = 100                        'Set delay to 100 ms
Poke TRISB, 0                   'Set port B lines output
start :                         'Forward stepper motor rotation sequence
sequence
Poke portB,1                    'Step 1
Pause ti                        'Delay
Poke portB,2                    'Step 2
Pause ti                        'Delay
Poke portB,4                    'Step 3
Pause ti                        'Delay
Poke portB,8                    'Step 4
Pause ti                        'Delay
Go to check                     'Jump to check switch status
start2:                         'Reverse motor rotation sequence
Poke portB,8                    'Step 1
Pause ti                        'Delay
Poke portB,4                    'Step 2
Pause ti                        'Delay
Poke portB,2                    'Step 3
Pause ti                        'Delay
Poke portB,1                    'Step 4
Pause ti                        'Delay
```

```
Go to check                 'Jump to check switch status
check:                      'Switch status
Peek portA, B0              'Peek the switch
If bit0 = 0 Then loop1      'If SW1 is closed, increased ti
If bit1 = 0 Then loop2      'If SW2 is closed, decreased ti
If bit2 = 0 Then hold3      'Stop motor
If bit3 = 0 Then start      'Go forward
Go to start2                'Go reverse
loop1:                      'Increase delay
Poke PortB,0                'Turn off transistors
ti = ti + 5                 'Increase delay by 5 ms
Pause 50                    'Delay
If ti > 250 Then hold1      'Limit delay to 250 ms
Peek portA,0                'Check switch status
If bit0 = 0 Then loop1      'Still incresing delay?
Go to check                 'If not, jump to main switch status check
loop2:                      'Decrease delay
Poke portB,0                'Turn off transistors
ti = ti - 5                 'Decrease delay by 5 ms
Pause 50                    'Pause
If ti < 20 Then hold2       'Limit delay to 20 ms
Peek portA, b0              'Check switch status
If bit1 = 0 Then loop2      'Still decreasing delay?
Go to check                 'If not, jump to main switch status check
hold1:                      'Limit upper delay
ti = 245                    'To 245 ms
Go to loop1                 'Go back
hold2:                      'Limit lower delay
```

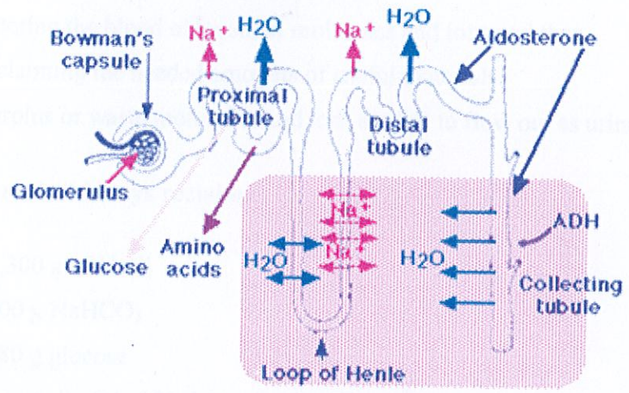
```
ti = 25                          'To 25 ms
go to loop2                      'Go back
hold3:                           'Stop stepper motor
Poke portB, 0                    'Turn off transistors
Poke portA, b0                   'Check switches
If bit2 = 0 Then hold3           'Keep motor off?
Go to check                      'If not, jump to main switch status check
```

```
INSERT INTO `pesakit` (`NRIC`, `NAME`, `ADDRESS`, `POSTCODE`, `CITY`,
`STATE`, `PHONE`, `PANEL`, `ALLERGIES`) VALUES("1", "1", "1", "1", "1",
"KUALA LUMPUR", "1", "1", "1");


#
# Table structure for table 'rawatan'
#

DROP TABLE IF EXISTS `rawatan`;
CREATE TABLE `rawatan` (
  `NRIC` varchar(12) NOT NULL default '0',
  `NAME` varchar(60) default NULL,
  `DAY` char(3) default NULL,
  `MONTH` varchar(20) default NULL,
  `YEAR` varchar(5) default NULL,
  `PULSE` varchar(15) default NULL,
  `BODY` varchar(15) default NULL,
  `BLOOD` varchar(15) default NULL,
  `REMARK` text
) TYPE=MyISAM;


#
# Dumping data for table 'rawatan'
#

INSERT INTO `rawatan` (`NRIC`, `NAME`, `DAY`, `MONTH`, `YEAR`, `PULSE`,
`BODY`, `BLOOD`, `REMARK`) VALUES("1", "1", "1", "AUGUST", "2003", "111",
"111", "111", "null");
INSERT INTO `rawatan` (`NRIC`, `NAME`, `DAY`, `MONTH`, `YEAR`, `PULSE`,
`BODY`, `BLOOD`, `REMARK`) VALUES("1", "1", "1", "JANUARY", "2000", "21",
"21", "21", "12");
INSERT INTO `rawatan` (`NRIC`, `NAME`, `DAY`, `MONTH`, `YEAR`, `PULSE`,
`BODY`, `BLOOD`, `REMARK`) VALUES("1", "1", "4", "MAY", "2006", "233",
"333", "33", "33333333333333333333333333333333333333 w w w w ");
```

```
DROP TABLE IF EXISTS `lab`;
CREATE TABLE `lab` (
  `NRIC` varchar(12) NOT NULL default '0',
  `NAME` varchar(60) default NULL,
  `DAY` char(3) default NULL,
  `MONTH` varchar(20) default NULL,
  `YEAR` varchar(5) default NULL,
  `BLOOD_PH` varchar(15) default NULL,
  `GLUCOSE` varchar(15) default NULL,
  `REMARK` text
) TYPE=MyISAM;


#
# Dumping data for table 'lab'
#

INSERT INTO `lab` (`NRIC`, `NAME`, `DAY`, `MONTH`, `YEAR`, `BLOOD_PH`,
`GLUCOSE`, `REMARK`) VALUES("1", "1", "1", "JANUARY", "2000", "1", "1",
"ttrtrt rtetr t ");


#
# Table structure for table 'pesakit'
#

DROP TABLE IF EXISTS `pesakit`;
CREATE TABLE `pesakit` (
  `NRIC` varchar(12) NOT NULL default '0',
  `NAME` varchar(60) default NULL,
  `ADDRESS` varchar(60) default NULL,
  `POSTCODE` varchar(5) default NULL,
  `CITY` varchar(25) default NULL,
  `STATE` varchar(40) default NULL,
  `PHONE` varchar(15) default NULL,
  `PANEL` varchar(60) default NULL,
  `ALLERGIES` varchar(60) default NULL,
  PRIMARY KEY  (`NRIC`)
) TYPE=MyISAM;


#
# Dumping data for table 'pesakit'
#
```

THE HUMAN KIDNEY:

- are two bean-shaped organs, one on each side of the backbone.
- Represent about 0.5% of the total weight of the body,
- but receive 20-25% of the total arterial blood pumped by the heart.
- Each contains from one to two million **nephrons**.



Link to graphic showing the location of the kidney and their blood supply (64K)

The Nephron

The nephron is a tube; closed at one end, open at the other. It consists of a:

- **Bowman's capsule**. Located at the closed end, the wall of the nephron is pushed in forming a double-walled chamber.
- **Glomerulus**. A capillary network within the Bowman's capsule. Blood leaving the glomerulus passes into a second capillary network (not shown in the figure) surrounding the
- **Proximal convoluted tubule**. Coiled and lined with cells carpeted with microvilli and stuffed with mitochondria.
- **Loop of Henle**. It makes a hairpin turn and returns to the

- **Distal convoluted tubule**, which is also highly coiled and surrounded by capillaries.
- **Collecting tubule**. It leads to the pelvis of the kidney from where **urine** flows to the bladder and, periodically, on to the outside world.

FORMATING OF URINE

The nephron makes urine by

- filtering the blood of its small molecules and ions and then
- reclaiming the needed amounts of useful materials.
- Surplus or waste molecules and ions are left to flow out as urine.

In 24 hours the kidneys reclaim

- ~1,300 g of NaCl
- ~400 g $NaHCO_3$
- ~180 g glucose
- almost all of the180 liters of water that entered the tubules.

The steps:

- Blood enters the glomerulus under pressure.
- This causes water, small molecules (but not macromolecules like proteins) and ions to filter through the capillary walls into the **Bowman's capsule**. This fluid is called **nephric filtrate**. As the table shows, it is simply blood plasma minus almost all of the plasma proteins. Essentially it is no different from interstitial fluid.

Composition of plasma, nephric filtrate, and urine (each in **g/100 ml** of fluid). These are representative values. The values for salts are especially variable, depending on salt and water intake.

Component	Plasma	Nephric Filtrate	Urine	Concentration	% Reclaimed
Urea	0.03	0.03	1.8	60X	50%
Uric acid	0.004	0.004	0.05	12X	91%
Glucose	0.10	0.10	None	-	100%
Amino acids	0.05	0.05	None	-	100%
Total inorganic salts	0.9	0.9	<0.9-3.6	<1-4X	99.5%
Proteins and other macromolecules	8.0	None	None	-	-

- Nephric filtrate collects within the Bowman's capsule and then flows into the **proximal tubule**.
- Here all of the **glucose**, and **amino acids**, >90% of the uric acid, and ~60% of inorganic **salts** are reabsorbed by active transport.
    - The active transport of Na^+ out of the **proximal tubule** is controlled by angiotensin II.
    - The active transport of phosphate (PO_4^{3-}) is regulated (suppressed by) the parathyroid hormone.
- As these solutes are removed from the nephric filtrate, a large volume of the water follows them by osmosis (80-85% of the 180 liters deposited in the Bowman's capsules in 24 hours).

- As the fluid flows into the descending segment of the **loop of Henle**, water continues to leave by osmosis because the interstitial fluid is very hypertonic. This is caused by the active transport of Na^+ out of the tubular fluid as it moves up the ascending segment of the loop of Henle.

- In the **distal tubules**, more sodium is reclaimed by active transport, and still more water follows by osmosis.

Medi-Test Glucose 3

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Back

The test strips Glucose 3 contain test pads for glucose, ketone and ascorbic acid.

Ordering Information

The detection is based on the glucoseoxidase-peroxidase-chromogen reaction. Apart from glucose, no other compound in urine is known to give a positive reaction.
The detection of ascorbic acid is based on the decolouration of Tillman´s reagent.

The glucose test must be repeated, if the ascorbic acid reaction is positive, however, at the earliest 10 hours after the last vitamin C intake.
Pathological glucose concentrations are indicated by a colour change from green to bluish green. Yellow or greenish testfields should be considered negative or normal. All test fields which have an intensity greater than the greenish negative colour field must be considered positive.

Larger amounts of ascorbic acid, which may be present in urine after high intake of vitamine C (vitamine tablets or fruit juice) can lead to lower or false negative results. In addition an inhibitory effect is produced by gentisic acid.

Falsly positive reactions can also be produced by a residue of peroxide-containing cleansing agents.

Because of the clear distinction between physiological and pathological glucosuria, the test is especially suitable for the detection of diabetes mellitus and for supervising and self-supervising of diabetes.

Every positive test reaction requires further diagnostics!

Ordering information:

Cat. No.	Product

93003	MEDI-TEST Glucose 3 pack of 50 strips Batch:	-
93026	MEDI-TEST Glucose 3 pack of 100 strips Batch:	-

Price information is available for registered customers only. Please click the 'login' button and log in with your personal password. If you are not registered with MN, please click the 'sign in' button and register your address. You will receive your personal password immediately as e-mail.
We offer price lists via internet only for the countries USA, GB, France, Switzerland and Germany. For other countries please contact our contract-distributor!

Underwriting Requirements -- Laboratory Tests

All of our paramedical examinations require the submission of a blood sample and a urine specimen. This information, in addition to all other underwriting requirements, is necessary for the determination of your premium rate class. In addition to the laboratory tests the examiner will also collect your physical measurements. Specific instructions will be provided to you before the exam. In general, these guidelines should be followed:

- For best results, fast at least eight hours before your scheduled examination appointment. Consult with your physician if you have a medical condition (diabetes, hypoglycemia, etc.) that may be adversely affected by fasting. If medically necessary, a non-fasting sample can be obtained. A fasting sample may be easiest for you to provide if the fasting period coincides with your regular sleep time. For your convenience, try to schedule the examination soon after you normally awake. Be sure to take all necessary prescriptions at your regularly scheduled time. Please inform the examiner of all such medications, including over the counter preparations, vitamins and herbs.

Drink only water prior to your appointment (if medically acceptable). Avoid coffee, tea and other caffeinated drinks because of caffeine's effect on blood pressure and heart rate. Avoid fruit juices because they contain natural sugars that can raise your blood sugar level.

Zurich Life Insurance Company will have your blood and urine analyzed by an approved laboratory. The results will be provided to us in a confidential manner for underwriting review. You will be given a copy of our Privacy Promise, Notice of Information Practices, Medical Information Bureau Notice, Federal Fair Credit Reporting Act Notice and HIV Consent Form (where applicable) in addition to any other required disclosure notification. These documents detail your rights and our privacy policies and practices related to the handling of your health and financial information.

Urine Glucose Testing

How urine glucose testing works

Many vets recommend urine glucose testing as a method of monitoring your pet's diabetes at home. It is simple and inexpensive. But it has some serious limitations that must be understood and taken into consideration.

Urine glucose testing is based on the fact that excessive amounts of glucose in the blood will be filtered by the kidneys into the urine. Once the amount of glucose in the blood exceeds the renal threshold, glucose is spilled into the urine. The renal threshold is the level at the kidneys can not "process" any more blood glucose and it spills into the urine. If the blood glucose is high for an extended period of time, glucose is usually present in the urine. The amount of glucose present in the urine depends on how high the blood glucose was, and how long the blood glucose was high.

Urine glucose test strips like the pictures shown below are used. The test strip has a little test area at the end that is dipped into urine or held in the urine stream. After a certain amount of time, the color of the test area is compared to a reference color chart. Bayer makes several types of urine tests strips. **Diastix** and **Clinistix** test only for urine glucose. **Keto-Diastix** test for both glucose and ketones. The Diastix have more "levels" of glucose measurement than the Clinistix. Follow the instructions that come with your test strips, and use the reference color chart on the bottle or box. The picture shown below is just an example - the colors are NOT to be used to compare your urine test strip.

The color chart tells you approximately how much glucose has spilled into your pet's urine.

Note: Different test strip brands use different numbers to indicate the amount of glucose in the urine. When talking to your vet, it is important that you are both thinking of the same value. For example

a "1" on one brand of strips may indicate very high urine glucose, while on another strip a "1" is a low urine glucose. A "trace" amount usually refers to the first non-negative color patch.

Here is a chart comparing the results you can obtain from Diastix, Keto-diastix, and Clinistix.

Diastix glucose	(%)	Negative	1/10	1/4	1/2	1	2
	(mg/dL)	Negative	100	250	500	1000	2000 or more
Keto-Diastix Ketone	(mg/dL)	Negative	5	15	40	80	160

Clinistix glucose	no units	Negative (pink)	Light (reddish)	Medium (maroon)	Dark (purple)
	might be referred to as:	negative	1	2	3

Generally, urine testing is more useful in dogs than in cats. Several dog owners use urine glucose testing to monitor their pet. Because it is usually more difficult to obtain a urine sample from a cat, and cats often hold their urine a long time, it can be very difficult to use urine glucose testing as an accurate method of determining the level of regulation in a diabetic cat.

Accuracy

In the case where an animal isn't regulated, or is difficult to keep regulated, home urine testing must be supplemented by some form of BG testing (either at home or at the vet). I don't think urine testing is accurate enough and there's too much of a time lag between the BG and the urine glucose levels for you to rely only on urine glucose levels to try to achieve regulation.

The inaccuracies of urine testing will be exaggerated in animals that urinate infrequently. This tends to be a problem with cats. The greater the amount of time between urination, the more averaged the urine glucose will be. That batch of urine was processed by the kidneys and collected in the bladder over a longer period of time.

Urine glucose tests may be more accurate on an animal that urinates frequently. In this case, the urine is processed and eliminated over a shorter time and the urine glucose will more

closely reflect what the blood glucose levels were. Also, urine testing may be more useful after the animal is regulated. Then you have a good idea that the bgs are within an acceptable range, and the urine tests can be used to double check to see if glucose is spilling into the urine.

Limitations of urine glucose testing

The level of glucose in the urine is not the same as the level of glucose in the blood. The urine level is just a reflection of how high the bg was, and how long it was above the renal threshold (the point where glucose spills into the urine). There will always be a difference between what shows up in the urine and what was actually in the blood, and the urine glucose levels will always lag behind the blood glucose levels.

Also, urine test strips can not show if the bg has ever gone too low. The strips are not designed to do this.

Urine testing may be a method that you can use to monitor your pet's diabetes. But keep in mind that urine testing has some serious limitations and may not work with your pet.

Our scary experience with Barney

I thought a good way to explain the difficulties we had with urine testing was to describe what happened with our cat Barney. Remember, each pet and circumstance is different, but our experience with Barney shows that urine testing can be very ineffective, and basing decisions about the insulin dose on just urine glucose test results can be dangerous.

When Barney was first diagnosed, the vet told us to test his urine glucose at home. We were instructed that if the urine tests were strongly positive for a few days, increase the insulin by 1/2 unit. If the tests were negative for a few days, decrease insulin by 1/2 unit. If the tests were weakly positive, we were to keep the insulin dose the same.

The vet also recommended that Barney come back for another day of bg testing. But I had read several articles about stress induced high BG readings and decided not to have the vet do BG testing. This is a very important factor in our situation. We did not have any BG curves done after the initial diagnosis (BIG mistake). We relied solely on urine glucose monitoring and behavioral observations such as urine volume, drinking, and physical activity. In hindsight, we should have had at least one or two BG curves done during this first 6 month period.

For the first 6 months, we seemed to have a lot of success in regulating Barney's diabetes just by using urine testing. We gradually adjusted his insulin dose as indicated by the urine test results. We started at 2 units once a day and were gradually up to 4.5 units twice a day. During this time, we also had a fructosamine test done. This test shows the average BG control over 2-3 week period. The results of this test were excellent. I still wondered about the daily BG highs and lows, but I was fairly comfortable that we had his diabetes adequately regulated.

But then his urine was always testing strongly positive again. By now, I had done a lot of reading about diabetes and had learned a lot of new things. I knew it was important for us to learn what his bg levels were throughout the day. I also worried about giving too much insulin and if he was having a Somogyi rebound. A Somogyi rebound can occur when too much insulin is given and causes the bg to go too low, then the body responds by dumping large quantities of glucose from the liver into the blood.

Remember, we didn't have any information about what his blood glucose levels were. The fructosamine test told us that his average BG control was good, but we didn't know the highs, lows, or how long the insulin was lasting.

So, we got a home BG meter and tested him. Here's what happened. It shows how inaccurate urine tests can be.

- 6 pm: Barney peed and the urine glucose test was strongly positive. I assume he emptied his bladder.
- 6:30 pm: gave him his insulin
- 10 pm: tested BG. It was dangerously low (<40mg/dL).
- 10:30 pm: (just 30 minutes after the bg test) he peed and the urine glucose test strip showed +2, lots of glucose in the urine.

So between 6 pm and 10:30 pm his BG dropped dangerously low, but the urine that he processed during that time contained lots of glucose.

If I was giving insulin based only on the urine test, I would have increased his insulin. This could have been a fatal mistake.

Barney's urine never tested negative for glucose even though his BG was very low for 2-3 hours of the day. The problem was that the amount of time that his BG was very low was too short, and could

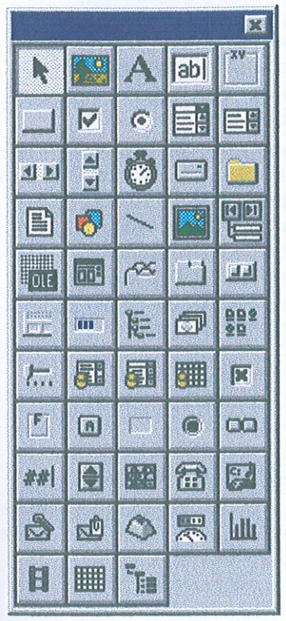
not be detected by urine testing. For part of the day his BG was too low, but for most of the day his BG was too high and lots of glucose always showed up in the urine.

The ONLY way I figured this out was to do a BG curve. Or the vet could have done a bg curve. But a bg curve had to be done.

A Little Humor

Taking care of a diabetic pet is stressful, and it's important to keep your spirits up. Bobbi, our resident lyricist has written "Where's The Dignity?". Maybe this is what your pet is thinking when he sees you get out the urine test strips.

Visual Basic ToolBox Reference



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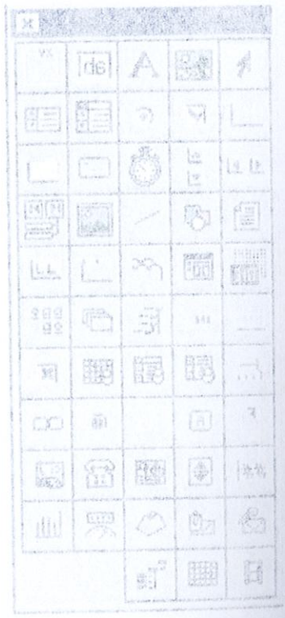
Vertical Scroll	Horizontal Scroll	Timer	Drive Box	Folder
File	Shape	Line	Image	Database
OLE	Common Dialog	SSTab	TabStrip	Toolbar
Status Bar	Progress Bar	Treeview	Imageview	Listview
Slider	DBList	DBCombo	DBGrid	SSCheck
SSFrame	SSCommand	SSpanel	SSOption	SSRibbon
Masked Edit	Spin	Picture Clip	Comm	MM Control
MAPI Session	MAPI Mssgs	KeyState	Gauge	Graph
AniPushButton	Grid	Outline		



VB Reference: Standard Controls

The Help system details the properties and methods and events in detail. But here is a master list that gives you an overview of the Standard Controls and what they support.

Name	Properties	Methods	Events
Check Box	Alignment, Appearance, BackColor, Caption, Container, DataChanged, DataField, DataSource, DragIcon, DragMode, Enabled, Font, FontBold, FontItalic, FontName, FontSize, FontStrikethru, FontUnderline, ForeColor, Height, HelpContextID, hWnd, Index, Left, MousePointer, Name, Parent, TabIndex, TabStop, Tag, Top, Value, Visible, WhatsThisHelpID, Width	Drag, Move, Refresh, SetFocus, ShowWhatsThis, ZOrder	Click, DragDrop, DragOver, GotFocus, KeyDown, KeyPress, KeyUp, LostFocus, MouseDown, MouseMove, MouseUp
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Command Button	Appearance, BackColor, Cancel, Caption, Container, Default, DragIcon, DragMode, Enabled, Font, FontBold, FontItalic, FontName, FontSize, FontStrikethru, FontUnderline, Height, HelpContextID, hWnd, Index, Left, MouseIcon, MousePointer, Name, Parent, TabIndex, TabStop, Tag, Top, Value, Visible, WhatsThisHelpID, Width	Drag, Move, Refresh, SetFocus, ShowWhatsThis, ZOrder	Click, DragDrop, DragOver, GotFocus, KeyDown, KeyPress, KeyUp, LostFocus, MouseDown, MouseMove, MouseUp
Common Dialog	**Color** Action, CancelError, Color, Flags, HelpCommand, HelpContext, HelpFile, HelpKey, Object **File** Action, CancelError, DefaultExt, DialogTitle, FileName, FileTitle, Filter, FilterIndex, Flags, HelpCommand, HelpContext,	ShowColor, ShowFont, ShowHelp, ShowOpen, ShowPrinter, ShowSave	

	HelpFile, HelpKey, InitDir, MaxFileSize, Object **Font** Action, CancelError, Flags, FontBold, FontItalic, FontName, FontSize, FontStrikethru, FontUnderline, HelpCommand, HelpContext, HelpFile, HelpKey, Max, Min, Object **Print** Action, CancelError, Copies, Flags, FromPage, hDC, HelpCommand, HelpContext, HelpFile, HelpKey, Max, MaxFileSize, Min, Object, PrinterDefault, ToPage		
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DB Combo	Appearance, BackColor, BoundColumn, BoundText, Container, DataChanged, DataField, DataSource, DragIcon, DragMode, Enabled, Font, ForeColor, Height, HelpContextID, Index, IntegralHeight, Left, ListField, Locked, MatchedWithList, MatchEntry, MouseIcon, MousePointer, Name, Object, Parent, RowSource, SelectedItem, SelLength, SelStart, SelText, Style, TabIndex, TabStop, Tag, Text, Top, Visible, VisibleCount, VisibleItems, WhatsThisHelpID, Width	Drag, Move, Refill, Refresh, SetFocus, ShowWhatsThis, Zorder	Change, Click, DblClick, DragDrop, DragOver, GotFocus, KeyDown, KeyPress, KeyUp, LostFocus, MouseDown, MouseMove, MouseUp
DBGrid	Align, AllowAddNew, AllowDelete, AllowRowSizing, AllowUpdate, BackColor, Bookmark, BorderStyle, Caption, ColumnHeaders, Columns, Container, DataMode, DataSource, DefColWidth, DragIcon, DragMode, Enabled, Font, ForeColor, HeadFont, HeadLines, Height, HelpContextID, Index, Left, LeftCol, Name, Negotiate, Object, Parent, RecordSelectors, RowDividerStyle, RowHeight, ScrollBars, SelBookmarks, SelEndCol, SelStartCol, TabIndex,	ColContaining, Drag, GetBookmark, Move, Rebind, Refresh, RowBookmark, RowContaining, RowTop, Scroll, SetFocus, ShowWhatsThis, Zorder	AfterColUpdate, AfterDelete, AfterInsert, AfterUpdate, BeforeColUpdate, BeforeDelete, BeforeInsert, BeforeUpdate, Change, Click, ColResize, DblClick, DragDrop, DragOver, GotFocus,

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File List Box	Appearance, Archive, BackColor, Container, DragIcon, DragMode, Enabled, FileName, Font, FontBold, FontItalic, FontName, FontSize, FontStrikethru, FontUnderline,	Drag, Move, Refresh, SetFocus, ShowWhatsThis, Zorder	Click, DblClick, DragDrop, DragOver, GotFocus, KeyDown,

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Grid	BackColor, BorderStyle, CellSelected, Clip, Col, ColAlignment, ColIsVisible, ColPos, Cols, ColWidth, Container, DragIcon, DragMode, Enabled, FillStyle, FixedAlignment, FixedCols, FixedRowsProperty Font, FontBold, FontItalic, FontName, FontSize, FontStrikethru, FontUnderline, ForeColor, GridLines, GridLineWidth, Height, HelpContextID, HighLight, hWnd, Index, Left, LeftCol, MouseIcon, MousePointer, Name, Object, Parent, Picture, Row, RowHeight, RowIsVisible, RowPos, Rows, ScrollBars, SelEndCol, SelEndRow, SelStartCol, SelStartRow, TabIndex, TabStop, Tag, Text, Top, TopRow, Visible, WhatsThisHelpID, Width	AddItem, Drag, Move, Refresh, RemoveItem, SetFocus, ShowWhatsThis, ZOrder	Click, DblClick, DragDrop, DragOver, GotFocus, KeyDown, KeyPress, KeyUp, LostFocus, MouseDown, MouseMove, MouseUp, RowColChange, SelChange
Hscroll Bar	Appearance, Container, DragIcon, DragMode, Enabled, Height, HelpContextID, hWnd, Index, LargeChange, Left, Max, Min, MouseIcon, MousePointer, Name, Parent, SmallChange, TabIndex, TabStop, Tag, Top, Value, Visible, WhatsThisHelpID, Width	Drag, Move, Refresh, SetFocus, ShowWhatsThis, ZOrder	Change, DragDrop, DragOver, GotFocus, KeyDown, KeyPress, KeyUp, LostFocus, Scroll
Image	Appearance, BorderStyle, Container, DataChanged, DataField, DataSource, DragIcon, DragMode, Enabled, Height, Index, Left, MouseIcon, MousePointer, Name, Parent, Picture, Stretch, Tag, Top, Visible, WhatsThisHelpID, Width	Drag, Move, Refresh, ShowWhatsThis, ZOrder	Click, DblClick, DragDrop, DragOver, MouseDown, MouseMove, MouseUp

Label	Alignment, Appearance, AutoSize, BackColor, BackStyle, BorderStyle, Caption, Container, DataChanged, DataSource, DataField, DragIcon, DragMode, Enabled, Font, FontBold, FontItalic, FontName, FontSize, FontStrikethru, FontUnderline, ForeColor, Height, Index, Left, LinkItem, LinkMode, LinkTimeout, LinkTopic, MouseIcon, MousePointer, Name, Parent, TabIndex, Tag, Top, UseMnemonic, Visible, WhatsThisHelpID, Width, WordWrap	Drag, LinkExecute, LinkPoke, LinkRequest, Move, Refresh, ShowWhatsThis, Zorder	Change, Click, DblClick, DragDrop, DragOver, LinkClose, LinkError, LinkNotify, LinkOpen, MouseDown, MouseMove, MouseUp
Line	Appearance, BorderColor, BorderStyle, BorderWidth, Container, DrawMode, Index, Name, Parent, Tag, Visible, X1, X2, Y1, Y2	Refresh, Zorder	
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Picture Box	Align, Appearance, AutoRedraw, AutoSize, BackColor, BorderStyle, ClipControls, Container, CurrentX, CurrentY, DataChanged, DataField, DataSource, DragIcon, DragMode, DrawMode, DrawStyle, DrawWidth, Enabled, FillColor, FillStyle, Font, FontBold, FontItalic, FontName, FontSize, FontStrikethru, FontTransparent, FontUnderline, ForeColor, hDC, Height, HelpContextID, hWnd, Image, Index, Left, LinkItem, LinkMode, LinkTimeout, LinkTopic, MouseIcon, MousePointer, Name, Parent, Picture, ScaleHeight, ScaleLeft, ScaleMode, ScaleTop, ScaleWidth, TabIndex, TabStop, Tag, Top, Visible, WhatsThisHelpID, Width	Circle, Cls, Drag, Line, LinkExecute, LinkPoke, LinkRequest, LinkSend, Move, PaintPicture, Point, Print, PSet, Refresh, Scale, ScaleX, ScaleY, SetFocus, ShowWhatsThis, TextHeight, TextWidth, ZOrder	Change, Click, DblClick, DragDrop, DragOver, GotFocus, KeyDown, KeyPress, KeyUp, LinkClose, LinkError, LinkNotify, LinkOpen, LostFocus, MouseDown, MouseMove, MouseUp, Paint, Resize
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Urine tests

There are a variety of urine tests that assess kidney function. A simple, inexpensive screening test, called a routine urinalysis, is often the first test administered if kidney problems are suspected. A small, randomly collected urine sample is examined physically for things like color, odor, appearance, and concentration (specific gravity); chemically for substances such a protein, glucose, and pH (acidity/ alkalinity); and microscopically for the presence of cellular elements (red blood cells, white blood cells, and epithelial cells), bacteria, crystals, and casts (structures formed by the deposit of protein, cells, and other substances in the kidneys' tubules). If results indicate a possibility of disease or impaired kidney function, one or more of the following additional tests is usually performed to more specifically diagnose the cause and the level of decline in kidney function.

- Creatinine clearance test. This test evaluates how efficiently the kidneys clear a substance called creatinine from the blood. Creatinine, a waste product of muscle energy metabolism, is produced at a constant rate that is proportional to the muscle mass of the individual. Because the body does not recycle it, all of the creatinine filtered by the kidneys in a given amount of time is excreted in the urine, making creatinine clearance a very specific measurement of kidney function.The test is performed on a timed urine specimen--a cumulative sample collected over a two to twenty-four hour period. Determination of the blood creatinine level is also required to calculate the urine clearance.
- Urea clearance test. Urea is a waste product that is created by protein metabolism and excreted in the urine. The urea clearance test requires a blood sample to measure the amount of urea in the bloodstream and two urine specimens, collected one hour apart, to determine the amount of urea that is filtered, or cleared, by the kidneys into the urine.
- Urine osmolality test. Urine osmolality is a measurement of the number of dissolved particles in urine. It is a more precise measurement than specific gravity for evaluating the ability of the kidneys to concentrate or dilute the urine. Kidneys that are functioning normally will excrete more water into the urine as fluid intake is increased, diluting the urine. If fluid intake is decreased, the kidneys excrete less water and the urine becomes more concentrated. The test may be done on a urine sample collected first thing in the morning, on multiple timed samples, or on a cumulative sample collected over a twenty-four hour period. The patient will typically be prescribed a high-protein diet for several days before the test and asked to drink no fluids the night before the test.
- Urine protein test. Healthy kidneys filter all proteins from the bloodstream and then reabsorb them, allowing no protein, or only slight amounts of protein, into the urine. The persistent presence of significant amounts of protein in the urine, then, is an important indicator of kidney disease. A positive screening test for protein (included in a routine urinalysis) on a random urine sample is usually followed-up with a test on a 24-hour urine sample that more precisely measures the quantity of protein.

Blood tests

There are also several blood tests that can aid in evaluating kidney function. These include:

- Blood urea nitrogen test (BUN). Urea is a by-product of protein metabolism. This waste product is formed in the liver, then filtered from the blood and excreted in the urine by the kidneys. The BUN test measures the amount of nitrogen contained in the urea. High BUN levels can indicate kidney dysfunction, but because blood urea nitrogen is also affected by protein intake and liver function, the test is usually done in conjunction with a blood creatinine, a more specific indicator of kidney function.
- Creatinine test. This test measures blood levels of creatinine, a by-product of muscle energy metabolism that, like urea, is filtered from the blood by the kidneys and excreted into the urine. Production of creatinine depends on an individual's muscle mass, which usually fluctuates very little. With normal kidney function, then, the amount of creatinine in the blood remains relatively constant and normal. For this reason, and because creatinine is affected very little by liver function, an elevated blood creatinine is a more sensitive indication of impaired kidney function than the BUN.
- Other blood tests. Measurement of the blood levels of other elements regulated in part by the kidneys can also be useful in evaluating kidney function. These include sodium, potassium, chloride, bicarbonate, calcium, magnesium, phosphorus, protein, uric acid, and glucose.

Preparation

Patients will be given specific instructions for collection of urine samples, depending on the test to be performed. Some timed urine tests require an extended collection period of up to 24 hours, during which time the patient collects all urine voided and transfers it to a specimen container. Refrigeration and/or preservatives are typically required to maintain the integrity of such urine specimens. Certain dietary and/or medication restrictions may be imposed for some of the blood and urine tests. The patient may also be instructed to avoid exercise for a period of time before a test.

Aftercare

If medication was discontinued prior to a urine kidney function test, it may be resumed once the test is completed.

Risks

Risks for these tests are minimal, but may include slight bleeding from a blood-drawing site, hematoma (accumulation of blood under a puncture site), or fainting or feeling light-headed after venipuncture. In addition, suspension of medication or dietary changes imposed in preparation for some blood or urine tests may trigger side-effects in some individuals.

Normal results

Normal values for many tests are determined by the patient's age and sex. Reference values can also vary by laboratory, but are generally within the ranges that follow.

Urine tests

- Creatinine clearance. For a 24-hour urine collection, normal results are 90-139 ml/min for adult males less than 40 years old, and 80-125 ml/min for adult females less than 40 years old. For people over 40, values decrease by 6.5 ml/min for each decade of life.
- Urea clearance. With maximum clearance, normal is 64-99 ml/min.
- Urine osmolality. With restricted fluid intake (concentration testing), osmolality should be greater than 800 mOsm/kg of water. With increased fluid intake (dilution testing), osmolality should be less than 100 mOSm/kg in at least one of the specimens collected.
- Urine protein. A 24-hour urine collection should contain no more than 150 mg of protein.

Blood tests

- Blood urea nitrogen (BUN). 8-20 mg/dl.
- Creatinine. 0.8-1.2 mg/dl for males, and 0.6-0.9 mg/dl for females.

Abnormal results

Low clearance values for creatinine and urea indicate diminished ability of the kidneys to filter these waste products from the blood and excrete them in the urine. As clearance levels decrease, blood levels of creatinine and urea nitrogen increase. Since it can be affected by other factors, an elevated BUN, by itself, is suggestive, but not diagnostic, for kidney dysfunction. An abnormally elevated blood creatinine, a more specific and sensitive indicator of kidney disease than the BUN, is diagnostic of impaired kidney function.

Inability of the kidneys to concentrate the urine in response to restricted fluid intake, or to dilute the urine in response to increased fluid intake during osmolality testing may indicate decreased kidney function. Because the kidneys normally excrete almost no protein in the urine, its persistent presence, in amounts that exceed the normal 24-hour urine value, usually indicates some type of kidney disease as well.

Terms:

Blood urea nitrogen (BUN)

The nitrogen portion of urea in the bloodstream. Urea is a

waste product of protein metabolism in the body.

Creatinine

The metabolized by-product of creatine, an organic acid that assists the body in producing muscle contractions. Creatinine is found in the bloodstream and in muscle tissue. It is removed from the blood by the kidneys and excreted in the urine.

Osmolality

A measurement of urine concentration that depends on the number of particles dissolved in it. Values are expressed as milliosmols per kilogram (mOsm/kg) of water.

Urea

A by-product of protein metabolism that is formed in the liver. Because urea contains ammonia, which is toxic to the body, it must be quickly filtered from the blood by the kidneys and excreted in the urine.