"I hereby declare that I have read through this report entitled "Design, Development and Fabrication of Urinal Health Checking System" and found that it has comply the partial fulfilment for awarding the degree of Bachelor of Mechanical Engineering (Design & Innovation)"

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DESIGN, DEVELOPMENT, AND FABRICATION OF URINAL HEALTH CHECKING SYSTEM

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This report is submitted in partial fulfilment of the requirements for the degree Of Bachelor of Mechanical Engineering (Design & Innovation)

Faculty of Mechanical Engineering
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JULY 2012

"I declare that this report entitle "Design, Development, and Fabrication of Urinal Health Checking System" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree"

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Date : JULY 2012

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ABSTRACT

Nowadays, people are busy with their routine daily life without the awareness of their own health. The lack of awareness could prove fatal if a harmless and hard detected illness developed into an incurable illness. Time and travelling are the main factor that most people neglect the idea of a medical check-up. The purpose of this project is to construct a urinal health checking system. The urinal will able to detect and process the urinal user's urine using current technology sensors. The result of the urine will than displayed on a displayer attached to the urinal. The design will follow the engineering design development process. The expected output is a low-cost urinal health checking system that could operate at public toilets.

ABSTRAK

Pada masa kini, manusia sibuk dengan kehidupan seharian mereka tanpa kesedaran tentang kesihatan mereka sendiri. Kurangnya kesedaran ini boleh membawa maut jika penyakit yang tidak berbahaya dan sukar dikesan berkembang menjadi penyakit yang tidak boleh diubati. Masa dan perjalanan adalah faktor utama kepada kebanyakan orang mengabaikan idea pemeriksaan perubatan.Tujuan projek ini adalah untuk membina sistem tempat air kencing berkebolehan memeriksa kesihatan. Tempat air kencing akan dapat mengesan dan memproses air kencing pengguna menggunakan sensor teknologi semasa. Keputusan air kencing akan dipaparkan pada displayer yang tersambung di tempat air kencing. Reka bentuk akan mengikuti proses pembangunan reka bentuk kejuruteraan. Output yang dijangka ialah kos rendah system tempat air kencing memeriksa kesihatan yang boleh beroperasi di tandas awam.

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LIST OF ABBREVIATION

HOQ	=	House of Quality
PDS	=	Product Design Specification
QFD	=	Quality Function Development
CATIA	=	Drawing Software
CAD	=	Computer Aided Data
FDM	=	Fused Deposit Modeling

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CHAPTER 1

INTRODUCTION

1.0 Background

Urine is waste product from the body in liquid form. It is secreted by the kidneys through a process called urination. There are a lot of things that a sample of urine could tell about a health of a person. Even back in history, many physicians had resorted to examination of their patient‟s urine. Hermogenes, a Greek philosopher wrote that colour and attribute of the urine could indicate whether a person is healthy or not. Another philosopher, Abdul Malik Ibn Habib of Andalusia mentions hundreds of report regarding urine examination. Nowadays, medical doctor still practice urine analysis to cure patients. There are many characteristic of the urine that could be observed. Colour, Odour, Turbidity (Cloudy), pH, Volume and Specific Gravity are examples of the characteristic that may defer respectively due to various factors.

Urinal is a specialized toilet that serves as a urinating place. Generally, the urinal is designed for the male, but it is possible that the urinal could be designed for the females. Public urinal is usually is attached to a wall where the user could stand for urinating. It also often contains plastic mesh guard, a guard from solid objects such as cigarettes or chewing gum to enter the urinal‟s system. These solid objects could cause blockage and will disrupt the system from flowing. Nowadays, a lot of designed urinals are available all across the world which offer more comfort, user-friendly and designed based on green technology.

1.1 Problem Statement

In this fast moving life, the percentage of people getting ill grew larger as they are busy with their hectic daily life. They simply neglect the idea of health check-up due to several factor. One of the main factors is that they are confident that they are in good health thus reducing the probability of doing a medical check-up. This lack of awareness could lead a preventable disease from harmless to dangerous. Example of a disease is diabetes where an earlier prevention could save the patient from experience painful condition.

Another factor is the idea of travelling to nearby hospital for a simple medical check-up. Most people opinion is that the travelling and waiting process at the hospital is troublesome and neglect the importance of knowing the condition of their own body.

1.2 Objective

- To design, develop and fabricate a low cost urinal that is able to advise regarding a person‟s health

1.3 Scope

- The urinal focuses on male either the elderly, adult and even children.
- The urinal could either constructed at any public places for any user who wants to check their health conditions.
- The urinal is a preliminary device which advise user to prevent diseases.
- The urinal health monitor could analyze the urine by these following characteristics:

i. Colour
ii. Clarity
iii. Specific Gravity
iv. pH
v. Sugar level (Glucose)

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The process of designing a new product requires vast amount of research and observation. Research on current trend, studies, and design guideline are vital as it provides the leverage and guidance on constructing a new product. Literature review on related topic offers knowledge and information for the success of the product as it provides solid foundation of a new design.

2.1 Urine Information

Urine is waste in liquid form and waste product of the human body. Normally, the urine is has a clear and transparent yellow colour. Average amount of urine produced in 24 hours range from 1200 ml to a maximum of 1800 ml which is about 1,200 cubic centimetres. Chemically, the urine is basically a watery solution of salt (sodium chloride) and substances called urea and uric acid. Normally, it contains about 950 parts of water to 40 parts of solid matter. Abnormally, urine may contain sugar or glucose (diabetes), albumen, a type of protein (a form of kidney disease), bile pigments (jaundice), or abnormal quantities of one or another of its normal components (William C.S. and Melissa C.R., 2008).

Urine acts as window to understanding disease of the kidney and systematic disorders. It is the easiest bodily fluid to obtain that can be analysed in resource limited settings where it is of great value in enhancing diagnostic and therapeutic pathways (Dreyer G., 2010).

2.1.1 Urine content

D. F. Putnam, (1971) provides the detailed description of the composition elements in human urine with thorough chemical analyses for organic and inorganic constituents, analysis methods, chemical and physical properties and its behavior during concentrative processes such as evaporation, distillation and other physiochemical operations. Urine is an aqueous solution of greater than 95% water, with the remaining constituents, in order of decreasing concentration urea 9.3 g/L, chloride 1.87 g/L, sodium 1.17 g/L, potassium 0.750 g/L, creatinine 0.670 g/L and other dissolved ions, inorganic and organic compounds.

Table 2.1: Element contain in normal human urine (Source: Web MD, 2008)

Element contain in normal human urine	
Water	Magnesium
Urea	Calcium
Creatinine	Ammonia
Uric Acid	Phosphates
Sodium	Sulfates
Potassium	

The list of elements that is normally contained in the human urine is shown in Table 2.1. Different element has different percentage of amount exist. However, there are some other substances that may be abnormally increases, normally indicate that there is something wrong with the health condition of the human body (Armstrong, 1998).

Table 2.2: Abnormal content in human urine (Source: Web MD, 2008)

Abnormal substance in urine	Cause
Albumin	May indicate that nephrons, are damaged or destroyed. Albuminuria is another term for elevated albumin
Bilrubin	May indicate obstructive or biliary disease.
Glucose	May indicate that a person may have diabetes.
Ketone bodies	May indicate anorexia or diabetes. Ketone bodies may also be elevated during starvation or during fasting.
Mircrobes	May indicate urinary tract infection
Blood	May indicate kidney damage, such as in kidney disease or renal. Kidney stones may also be the reason for the present of blood
White blood cells	May indicate that there is infection in the kidney or other organs of the urinary tract.

The examples of element that are not supposed to exist in the human urine are shown in Table 2.2. These elements existence in the urine may act as an indicator of an illness. Urine testing is one of effective method of diagnosing the patient‟s illness.

2.1.2 Characteristic of urine

Urine could be characterized through different factors (David F.P, 2008):

i. Quantity

The average quantity of a person urine ranges from 1200 ml to 1800 ml in an adult man daily routine. It may vary with the amount of fluid intake of the body. In fact it is connected with the protein metabolism; higher is the protein intake, the higher will be the urinary output since the urea created from the protein needs to be flushed out from the body. Higher is the urea production in the body, the higher is the volume of urine to dispose it.

ii. Color

The color is normally to be clear pale amber without any deposits. However, a light flocculent cloud of mucus may sometimes be seen in the normal urine. Known color of urine:

- Dark yellow urine
- Yellowing/Light orange urine
- Orange urine
- Bloody urine
- Dark orange to brown urine
- Black or dark-coloured urine
- Fluorescent yellow/Greenish urine
- Reddish urine

iii. Specific gravity

It varies from 1.010 to 1.025. Specific gravity is determined with using a specific gravity meter, Urinometer.

iv. Odour

Slightly nutty odour but some disease may change the smell of the urine. Some are sweet, fruity while others are bad.

v. pH

The normal urine is has a slightly acidic characteristic with an average pH of 6.0.

2.2 Urine testing/Urinalysis

Urine tests works for offering information to aid inside diagnosis, monitoring and also treatment of many illnesses. Additionally, the urine test can easily determine whether a lady is ovulation or she is pregnant. Urine can also be examined to get a selection of substances concerning drugs substance abuse, both within rehab programs as well as in the world of professional sports activity. The urine can be examined swiftly utilizing a strip of special paper, which can be submerged with the actual urine just after urination. This may show any kind of irregular elements in the urine for instance glucose, protein, or perhaps blood. If further examinations are required to obtain more data, the particular urine will probably be examined in a clinical (Armstrong L.E., 1998).

The kidney secreted waste material, minerals, fluid, and other substances from the blood out in the liquid form of urine. Urine contains hundreds and hundreds of different body wastes. What kind of food ate, drank, how much exercise done, how well the kidney works can affect the content of the urine. A regular medical check-up urinalysis often includes tests of urine,,s color, clarity, specify gravity and etc (J.R Raymond, 1995).

2.2.1 Urine test: Color

A lot of things affect urine color, such as liquid stability, diet plan, medications, as well as illnesses. The color of the urine, whether light or dark colored, could tell a person‟s water intake. B vitamin can make the urine into bright yellowish color. Some medicines, blackberries, vegetables, rhubarb, or blood contained in the urine can change urine color to red-brown color.

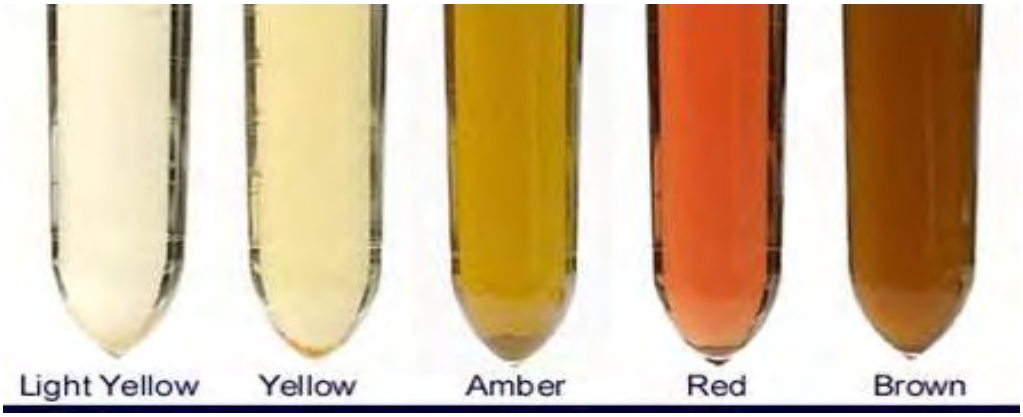

Figure 2.1: Example of urine color (Source: Jacobs, 2009)

Examples of colors that the urine may possess are shown in Figure 2.1. If the water in human body is balanced, the actual urine should typically a light yellow-colored. If the water intake is lesser than required, the urine may be amber in color Different type of food diet may affect the color of the urine such as red or brown. When normal mineral waters reduce in the body surpasses the water intake per-day, the kidney system have to conserve normal mineral waters, therefore making the actual urine a lot more concentrated with waste product and the color is darker. Dim yellowish urine is the perfect indicator how the individual is not properly hydrated which the particular fluid consumption should be improved.

If a person urinates under two times daily as well as/ or producing urine with darker color, this is a vital indicator regarding severe dehydration; the person need to consume water right away or the body will be in danger. Using the colour of the urine, testing whether the person is well hydrated could be tested.