Conference Paper

Independent Urine Measurement Based on Internet of Things

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Abstract

This study aims to create an independent urine measuring instrument based on the internet of things (IoT). This study was to see the differences in uroflometric measurements using an independent urine measuring based IoT tool compared to uroflometry in the urology clinic. The sampling method used was consecutive sampling with a total of 32 respondents. Uroflometry measurements were carried out twice, first using an independent urine measuring device based on the IoT, secondly using the standard uroflometric peak flow rate examination in the urology clinic. The results of measuring the average amount of urine per second using an independent urine measuring device based on IoT 22.22 ml / second, the average peak flow rate using uroflometry in the urology clinic is 23.97 ml / second, this shows that an independent urine measuring instrument based on IoT is not significantly different from uroflometry in urology polyclinic with a *p* value of 0.411, which indicates Ho was accepted, meaning there was no difference between the mean amount of urine per second and the average peak flow rate using uroflometry in the urology clinic. This study therefore concludes that an independent urine measuring devise based on the IoT instrument is effective for measuring urine emission per second. Suggestion: Follow up on the patent and legality of measuring instruments

Keywords: independent urine measuring instrument, internet of things(IoT), uroflometry, urethral stricture

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1. Introduction

Urethral stricture is a narrowing of the lumen of the urethra due to scar tissue and contractions[1]. Common causes of urethral stricture are due to urethral injuries (due to insertion of surgical instruments during trans-urethral surgery, indwelling catheters or cystoscopic procedures), stretch injuries and injuries related to car accidents, untreated gonorrhea urethritis and congenital abnormalities [2–5]. Long-term use of urethral catheters for drainage should be avoided and thorough care should be taken of any type of urethral device including catheterization, in an effort to prevent urinary tract infections, which can progress to urethral strictures [4, 6, 7].

Symptoms that occur in urethral strictures are the strength of the jets and the amount of urine that can be excreted is reduced so that symptoms of infection and urine retention can occur. If not treated promptly, urethral strictures lead to backflow and lead to cystitis, prostatitis and pyelonephritis [8].

The impact of the stricture most often felt by patients is a severe pain in the supra pubic area [9]. This is due to urine retention, where the accumulation of urine in the bladder exceeds capacity[10–12]. In addition, urine output becomes disrupted which is influenced by the degree of narrowing of the urethra. The heavier the degree of urethral narrowing, the more difficult it is for urine to pass, even until it doesn't come out at [4, 13]. The impact of stricture on body organs is even more severe is the occurrence of kidney failure due to back flow of urine to the kidneys [14].

The special action taken for urethral stricture is careful busination (dilation) with metal plugs, this can be used as an anticipation to prevent urethral stricture from occurring and urethral stricture recurrence[15, 16]. Uroflometry measurements, usually carried out in a laboratory, use a uroflometer, which has a sensor device[17–20]. The maximum normal flow value for men is 15 ml / second and for women 25 ml / second [15, 16].

Patients with urethral stricture, even though they have been declared cured, still need control at least once every six months to check the uroflometry and if the uroflometry results decrease, then busination is carried out [4, 21].

This study aims to create an independent urine measuring instrument based on IoT. This study was to see the differences in uroflometric measurements using an independent urine measuring based IoT tool compared to uroflometry in the urology clinic.

The author wants to try to modify the uroflometric measurement by creating an independent uroflometric measurement model, which is measuring the emission of urine per second using an internet based independent urine measuring instrument.

2. Methods and Equipment

2.1. Methods

This research is a different test study, in which the same group of respondents is exposed to two different treatments in separate time periods. The first treatment was measured uroflometry using an independent urine measuring device based on the internet of things and at different times uroflometry was measured using uroflometry in the urology clinic.

The variable in this study was the volume of urine per second using an independent urine measuring device based on the internet of thing, the result was the volume of urine per second (... ml / second)

2.2. Population and Sample

The population in this study were all patients suffering from urethral stricture at Dr. Hasan Sadikin Bandung who met the following inclusion criteria:

1. Patients with urethral stricture who can urinate spontaneously through the urethral meatus and do not experience impaired kidney function.
2. Patient awareness of compost mentis.
3. Patients are willing to participate by conducting education to perform independent uroflometric measurements

The exclusion criteria were:

1. The patient does not have a permanent place of residence, making it difficult to follow up the study
2. There are ethical barriers
3. The patient refuses to participate
4. Patients en route to not meeting the inclusion criteria
5. The patient appears very ill
6. The patient is not cooperative

2.3. Sample size

This study compared pre and post, so that the calculation of the sample size involved in this study used the paired group mean difference test formula. The formula used [22, 23].

$$n = \frac{(Z\alpha + Z\beta)^2 \pi}{(p_1 - p_2)^2}$$

$$\pi = (p_1 q_2) + (p_2 q_1)$$

$$n = \frac{(1,96 + 1,84)^2 .0,56}{(0,4)^2} = 27,44 \text{ rounded } 28$$

Researchers will add a sample of 10% to anticipate a drop out or loss of follow-up, so that the sample is corrected to 32 patients.

The sample selection technique in this study was selected by consecutive sampling [24].

2.4. Implementation Stage

1. After giving an explanation of the plan to be used as a research respondent, followed by informed consent, it is followed by giving a detailed explanation of the research process to be carried out.
   (a) Respondents are given to drink 1 liter of mineral water and asked to drink and drink it at the same time
   (b) Respondents were asked to take walks around the research location, namely in the urology clinic RSHS Bandung
   (c) After the respondent feels an unrestrained urge to urinate, the respondent is asked to urinate using an independent measuring device and the results are obtained from the amount of urine, the time required to pass urine and the amount of urine per second
2. One hour after the first urine collection, followed by the second sampling by:
   (a) Respondents are given to drink 1 liter of mineral water and asked to drink and drink it at the same time
   (b) Respondents were asked to take walks around the research location, namely in the urology clinic RSHS Bandung
   (c) After the respondent feels an unrestrained urge to urinate, the respondent is asked to urinate using uroflometry at the urology clinic and the results are Voided Volume (ml) Voided Time (S) Peak Flow Rate (ml / second)

2.5. Measurement of urine with independent urine measuring instruments based on the internet of things (Equipment).

1. Independent uroflometry measurement, is a non-invasive measure by measuring urine emission using an internet-based independent urine measuring device.

(a) Tools preparation:

  i. Internet-based independent urine measuring instrument of thing in the form of a measuring cup with a volume of 1000 ml, which has a sensor installed

  ii. Cellphone that has application facilities and online wifi internet

  iii. Battery power (supply voltage 5 Volt DC)

(b) Implementation of independent uroflometric measurements

  i. The patient is asked to urinate in a measuring cup, when the urine starts to come out, the power is turned on

  ii. The application is turned on for the cellphone, and the independent uroflometry device is connected to a power supply, then the uroflometry is turned on by pressing the on button and pressing the calibration button, and then uroflometry will record the urine that comes out by producing a volume number of urine issued, the time it takes and the amount of urine passed per second

  iii. When the patient stops urinating, the power is turned off

  iv. The results of uroflometric measurements using an internet-based independent urine measuring device of thing are the amount of urine that comes out divided by the time it takes to urinate, the result is ml / second (urine volume (ml): time (seconds) = …… ml / second).

  v. Male 15 ml / sec and female 25 ml / sec

Internet of Things-Based Urine Measurement Tool is a measuring device for measuring the volume of urine per unit time (seconds) which can automatically read changes in urine volume in a 1000 ml vessel in realtime and display it online in a web-based application via the internet network. The measurement method is carried out by using a calibrated weight sensor to detect changes in the volume of urine collected in a vessel with a capacity of 1000 ml. The time to fill the urine in the vessel will be calculated using the counter system (time-counter) in the microcontroller. By knowing the volume of urine collected in the vessel and the time required for the urine storage process, it is possible to determine the rate of urine volume per second. Measurement result data is sent through an internet of Things based application.

System specifications:

1. Supply voltage: 5 Volts DC

2. Maximum urine volume: 1000 ml

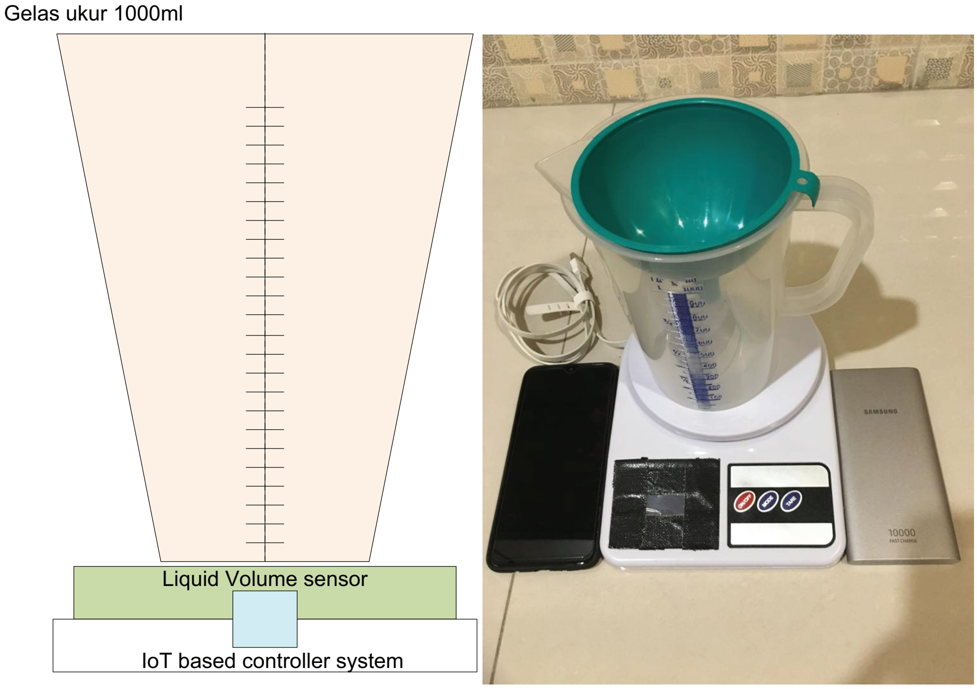

Figure 1: Independent Urine Measurement System Based On Internet of Thing (IoT)

3. Communication system: wifi

4. OLED Display

2.6. Data analysis

The stages of data analysis in stage two research are as follows:

2.6.1. Univariate analysis

Univariate analysis was performed to describe the variables descriptively. Categorical scale variables are presented in the form of a percentage, while numeric scale variables are presented as means along with standard deviations.

2.6.2. Bivariate Test

Do the data normality test first, using the kolmogorov smirnov column because the respondent is 32 people, if the data is normally distributed then a different test is done using the dependent t-test, and if the data is not normally distributed then the different test is done using Wilcoxon.

Testing the difference in the mean of urine measurement data per second using an independent urine measuring instrument based on the internet of thing with urine measurement data using uroflometry in the urology clinic will be done using a dependent t-test. This test is conducted to determine whether there is a difference in data between measurements using an independent internet of thing-based urine measuring instrument and measurements using uroflometry in the urology clinic.

3. Result

This research was conducted at Dr Hasan Sadikin Hospital in Bandung, from August to October 2019. Respondents in this study were patients at the Urology Clinic RSHS Bandung, totaling 32 respondents. Respondents were tested for urine emission per second twice, using independent urine measurement tools and uroflometry at the urology clinic RSHS Bandung. The research results can be seen in the table below.

Table 1: Total Urine, Duration of Urinating and Amount of Urine per second using an independent urine measuring instrument based on IoT

Variable	Mean ± SD	Min.	Max.
Total Urine (ml)	379,53 ± 156,466	172	866
Duration of urinating (seconds)	20,59 ± 14,057	8	80
Amount of urine per second (ml/sec)	22,2169 ± 7,39894	10,11	40,1

Based on the data above, it shows that the average amount of urine is 379.53 ml, the length of time to urinate is 20.59 seconds and the amount of urine per second is 22.2169 ml / second.

Table 2: Voided Volume, Voided Time and Peak Flow Rate per second using a uroflometry in urology clinic

Variable	Mean ± SD	Min.	Max.
Voided Volume (ml)	333,09 ± 135,448	93	642
Voided Time (S)	32,666 ± 17,0624	12,3	88
Peak Flow Rate (m/s)	23,975 ± 10,0732	6,8	57,4

Based on the data above, it shows that the average voided volume is 333.09 ml, the voided time is 32,666 seconds and the peak flow rate is 23,975 ml / second.

Based on the data above, it shows that the time data for urinating using an independent urine measuring device based on the internet of things is not normally distributed with a p value of 0.000, and the voided volume is not normally distributed with a *p* value of 0.012, the peak flow rate is not normally distributed with a *p* value of 0.002 The measurements were taken using uroflometry in the urology clinic.

Table 3: Results of Normality Test Data

Variable	KOLMOGOROV SMIRNOV	
	Df	Sig
Total Urine (ML)	32	0.200
Duration of urinating (seconds)	32	0.000
Amount of urine per second (ml / sec)	32	0.071
Voided Volume (ml)	32	0.200
Voided Time (S)	32	0.012
Peak Flow Rate (m/s)	32	0.002

Table 4: Differences Emount Urine, Voided Time and Amount of Urine per second between using an independent measuring device based on IoT with a uroflometry device in the urology clinic

No	Variable	Mean	n	Difference	Correlation coefficient	*p-Value*
1	Amount of urine (ml) Voided volume (ml)	379.53 333.09	32 32	46.438	0.263	0.150
2	Time to pee (second) Voided time (second)	20.59 32.66	32 32	-12.075	0.020	0.001
3	Amount of urine / second (ml / second) Peak Flow rate (ml/second)	22.2169 23.975	32 32	-1.758	0.466	0.411

Based on the data above, it shows that there is no difference in the examination of urine emission per second examination using an independent urine measuring instrument based on the internet of thing with peak flow rate examination using uroflometry in the urology clinic *p*-value 0.411> α 0.05. Hypothesis 0 is accepted, meaning that there is no difference in the urine emission examination using an independent urine measuring device based on the internet of things and the peak flow rate examination using uroflometry in the urology clinic. There was no difference in examining the amount of urine using a self-measuring instrument with voided volume examination using uroflometry in the urology clinic p value 0.150> α 0.05, meaning that there was no difference in examining the amount of urine using an independent measuring instrument with voided volume examination using uroflometry in the urology clinic. There is a difference in checking the time to urinate using an independent urine measuring device based on the internet of things with voided time using uroflometry in the urology clinic, *p* value 0.001, meaning that there is a difference in time to urinate using an independent urine measuring device based on internet of things with voided time using uroflometry in urology clinic

4. Discussion

Urethral stricture is a narrowing of the urethral lumen caused by the growth of fibrotic tissue, even though surgery has been performed, fibrotic tissue growth will continue throughout its life, so preventive measures such as busination are needed. Businasi action can be carried out every 6 months and lasts for life.

Uroflometric measurements can be used as a guide when it is necessary to carry out the action of busination to prevent recurrence of stricture, because of this it is very important for the role of a specialist nurse to provide health education, especially for urethral stricture patients to take uroflometric measurements independently, so that they can be used for early detection. when to control and to do busination to prevent re-urethral stricture.

The most common medical measures are internal urethrotomy with sachze and uretroplasty if uretrocutaneous fistula has occurred [25, 26].

The catheter is inserted for 2 - 3 days after the procedure if there is no fistula, if the urethroplasty the catheter is in longer, until the fistula is completely healed, it can take up to 2 weeks to 3 months [26].

After the patient is discharged and if the catheter has been removed, the patient must still be controlled every week until one month then every month for up to 6 months and every 6 months for life [8]. At the time of control, a uroflometric examination was carried out if Q (urine emission per second) was a maximum of 10 ml / second, then the busination was carried out[16].

In this study, the data showed that there was no difference in the examination of urine emission per second using an independent urine measuring device based on the internet of things with a peak flow rate examination using uroflometry in the urology clinic p-value 0.411> α 0.05, and there was no difference in examining the amount of urine using a measuring instrument. independently by examining voided volume using uroflometry in the urology clinic p value 0.150> α 0.05. From the results of these data it can be interpreted that an independent internet-based urine measuring device of thing can be used to measure urine emission per second and the amount of urine, as early detection in urethral stricture patients who require routine uroflometric examinations, so that a decrease in urine emission per second can be detected [28]. Early on so that the measurement of urine output using an independent internet based urine measuring device of thing can be used to predict the degree of urethral stricture and can be used as a medical follow-up consideration for what needs to be done in patients with urethral strictures. There was a difference in time to urinate using an independent urine measuring device based on the internet of things and voided time using uroflometry in the urology clinic, *p* value 0.001. The difference between the time to urinate using an independent measuring device and the voided time using uroflometry at the urology clinic, this is because the number of respondents' urine checked with an internet-based independent urine measuring device of thing with voided volume measured using uroflometry in urology clinics is different so that the time it takes to pass urine varies, adjusting the amount of urine excreted, but urine output per second does not differ significantly.

In this study, measurement results were not significantly different between uroflometry in urology clinics with independent urine measuring on based IoT device, so that the results of this study are in line with the expectations of researchers that independent urine measuring an based IoT device can be used to measure urine emission per second such as uroflometry in clinics. urology, which needs to be followed up is a license to be used in general.

5. Conclusion

5.1 There is no difference in the results of measuring the average amount of urine per second using an independent urine measuring device based on the internet of things with an average peak flow rate per second using uroflometry at the urology clinic, with a p value of 0.411> α 0.05, which means that the null hypothesis is accepted, meaning no the difference in measuring the amount of urine per second using an independent internet-based urine measuring device of thing with a peak flow rate per second using uroflometry at the urology polyclinic

5.2 Independent urine measuring instrument based IoT effective for measuring urine emission per second

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Conflict of Interest

The authors have no conflict of interest to declare

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