CHAPTER I

INTRODUCTION

1.1 Background

Uroflowmetry is now an in-office method used to determine the parameters of urine excretion while respecting patient privacy. [1] The volume of urine discharged over a period. It enables the assessment of void volume (voided volume), voiding time, average flow rate (Qavg), and maximum flow rate (Qmax), as well as aberrant flow patterns.[2]

When uroflowmetry is performed, the patient urinates into a particular bucket in a private location after a strong urge to void. If an abnormal void arises, frequent evaluations are necessary. Therefore, precision in uroflowmetry requires time, space, and privacy, which may be challenging in a clinic/hospital setting. Moreover, some individuals may have trouble urinating in a foreign environment or due to a painful or excessive voiding duration, necessitating repeated tests to obtain correct results.[3]

Latest uroflowmetry technologies have been developed in response to the need for accessible and portable home devices. These advancements include mobile acoustic uroflowmetry (sonouroflowmetry), optical uroflowmetry, and video-based emptying devices. [3]–[5] In contrast to the standard approach, acoustic uroflowmetry may be done at home using a smartphone rather than an outpatient clinic-based uroflowmetry.[6] The method's actual strength is in its adaptability and simplicity.[7]

When uroflowmetry is performed, the patient urinates into the uroflowmeter in a private location with a normal to a strong urge to void. Frequent evaluations are necessary to restore normal behavior if an abnormal void arises. As a result, precision in uroflowmetry requires time, space, and privacy, which may be challenging in an office setting. However, some individuals may have trouble urinating in a novel setting or due to a painful or excessive voiding duration, necessitating repeated tests to obtain correct results. [3]

Latest uroflowmetry technologies have been developed in response to the need for accessible and portable home devices. These advancements include sonouroflowmetry, optical uroflowmetry, and video-based emptying devices. [3]–[5]. In contrast to the standard approach, acoustic uroflowmetry may be done at home using a smartphone rather than an outpatient clinic-based uroflowmetry regardless of time or space limitations. [8] The method's actual strength is in its adaptability and simplicity. [7] Machine learning has aided in the identification of breast cancer and retinal disorders. Machine learning is a subfield of artificial intelligence (AI) that uses algorithms to improve accuracy and reliability over time as more data is analyzed. Machine learning has been chiefly used in urology, namely urologic cancer, endourology, and hydronephrosis/urinary reflux. Sonouroflowmetry has advanced dramatically during the last twelve years. [9]

The urine flow rate was first measured using a weight transducer, rotating disc, or capacitor change. It is feasible to assess urine flow by measuring the acoustic fluctuations at the air-water interface caused by the urine stream's interaction with the toilet water surface. [10] When Hitt et al. used sound to quantify urine flow in 2009, they established the viability of connecting acoustic and flowed parameters.[11]In 2011, Zvarova et al. (2011) released comparable sonouroflowmetry findings. [12]They observed that whereas men had equal flow curves, there were modest differences in the time of voiding and rate of flow when compared to standard uroflowmetry. [13] Previously published research examined a novel Sono uroflowmetry technique for describing and forecasting urine flow rate by capturing the sound of urinating using a smartphone. [13], [14]

The uroflowmetry pattern analysis is interpreted by urologist. To date, there is still no other method other than using urinary flow patterns to predict lower urinary tract diseases. This study will utilize sound measurement to predict the outcome of patients' lower urinary tract diseases.

1.2 Problem Identification

The problem identification in this study are:

a. How is the sound profiling of urinary flow?
b. How is the implementation of Deep Learning to differentiate between normal and abnormal voiding sound?

1.3 Study Limitations

The limitations in this study are

a. Measurement of quantitative urine data based on urine sound profile
b. Implementation of machine learning to enhance the data analysis

1.4 Formulation of the Problems

a. How is the accuracy and reliability of the novel sonouroflowmetry compared to traditional uroflowmetry?
b. How to classify the normal and abnormal voiding pattern using deep learning method based on the voiding sound of the patients?

1.5 Aim of the Study

The aim of this study is to compare the accuracy and reliability of the novel machine learning augmented acoustic uroflowmetry and conventional uroflowmetry.

1.6 Systematics of the Study

The systematics of the study is divided into five chapters as follows:

- Chapter I Introduction. This chapter discusses a brief description of the background of the problem of this research was carried out to reach the research objectives
- Chapter II Theory Study. This chapter discusses the theories or the research that has been carried out related to the formulation of the problems discussed in Chapter 1. This section is the crucial part of determining the method that will be used in the next section.
- Chapter III Research Methodology. This chapter contains the research design
- Chapter IV Results and Discussion. Elaborate the results of the research and make an argument for what is produced by attaching a paper or scientific work that has been or will be published.
- Chapter V Conclusions and Suggestions. This chapter describes the conclusions based on the results of the research obtained, as well as constructive suggestions that need to be developed for future research.
- At the end of this paper, a bibliography, appendices, and curriculum vitae of the researcher are attached.