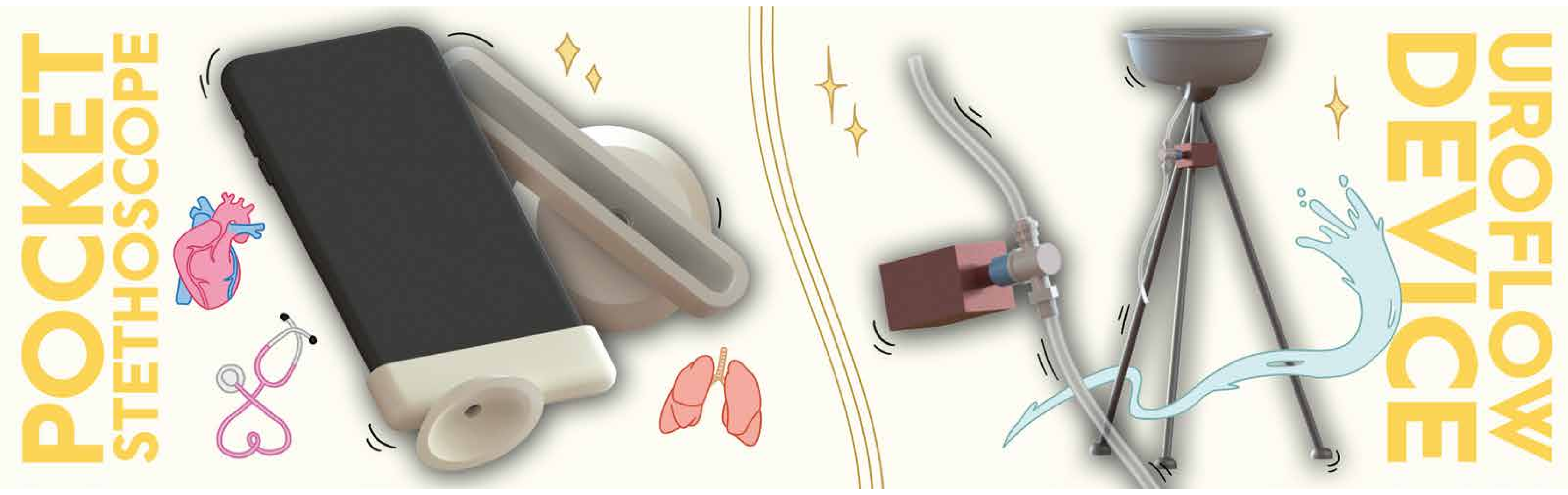
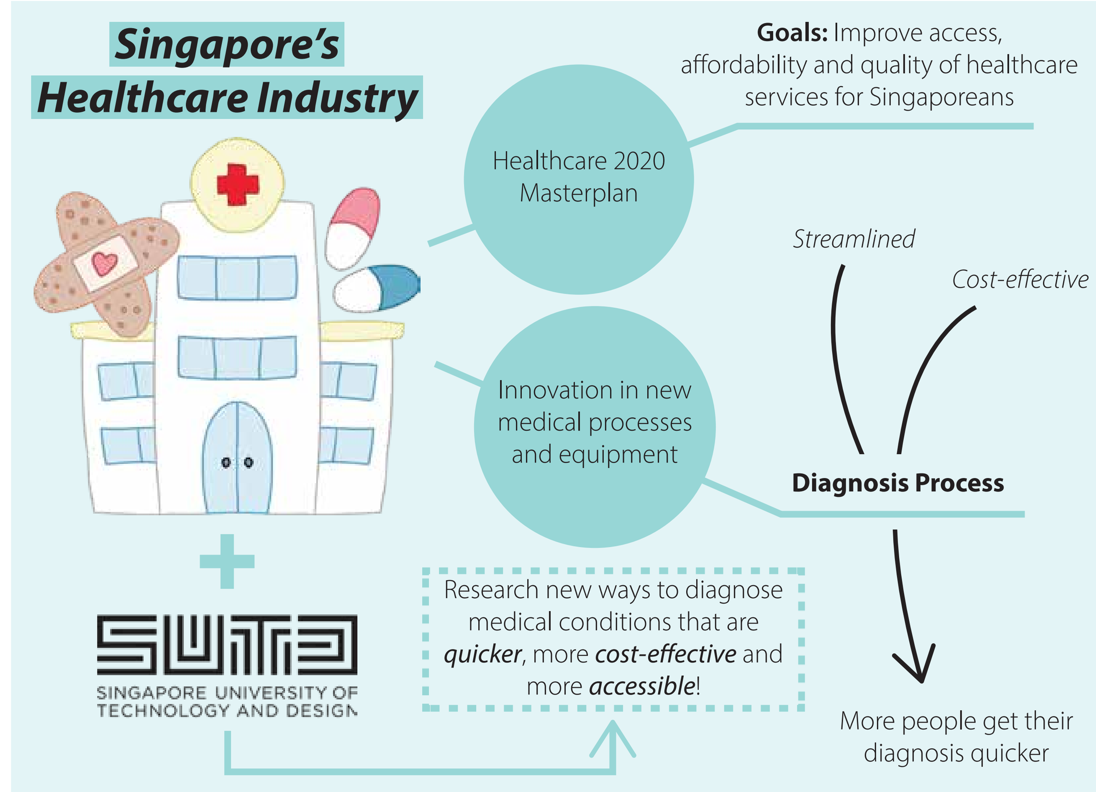
# Internships

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN



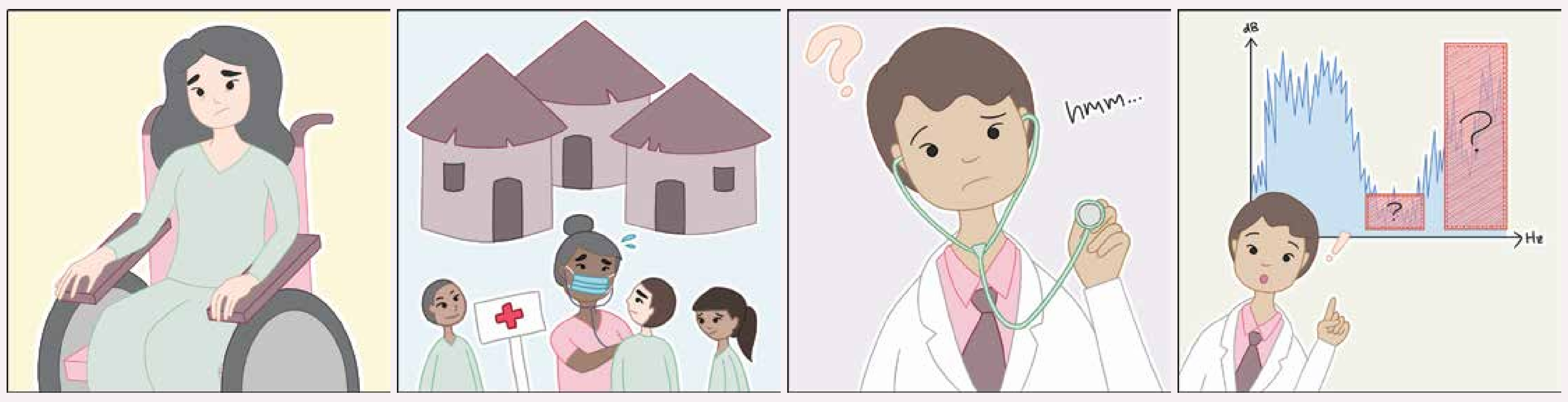

## What are Stethoscopes Used For?

Used to **amplify internal sounds** of the human body (e.g. lungs, heart and gastrointestinal system sounds) ➪ Sounds give doctors **quick insights** into patients' health conditions and help doctors **detect abnormalities**

Stethoscopes are one of the **cheapest** and most **portable** diagnostic tools available + Stethoscopes can sometimes detect medical problems that **newer technologies** (i.e. ultrasound) could not ➪ Stethoscopes remain the **first line of diagnostic inquiry** for many doctors

## Pocket Stethoscope: *The Problem*

Proper utilization of stethoscopes in medical assessments requires professional medical training and years of medical experience, and hence...




In-house patients might be unable to properly utilize stethoscopes ➪ need to travel frequently for check-ups

Stethoscopes might be under-utilized in less developed countries that lack medical staff

Inexperienced doctors might be unable to detect certain medical problems or abnormalities

Sounds of lower decibels / certain frequencies might not be picked up by the human ear ➪ potentially undiscovered medical data

## Pocket Stethoscope: *The Solution*

### ▸ What is it

Pocket Stethoscope is a ***3D printed*** stethoscope sleeve that can be attached to different smartphones

Diagnosis tool made ***simple*** and ***accessible***

Connects health and technology: Application helps interpret sounds recorded using Pocket Stethoscope

*Inexpensive* 3D-print

Over ***3 billion*** smartphone users worldwide

### ▸ How it works

Pocket Stethoscope ***amplifies*** internal sounds of the human body

→ Smartphone's microphone record sounds

Application ***analyses*** recordings and uses machine learning to extract useful medical data from them

Recordings sent to doctor for further assessment and record-keeping

## What is Uroflowmetry?

Uroflowmetry is a **non-invasive test** that involves measuring the **flow of urine** — specifically doctors are looking to track *how fast* urine flows, *how much* flows out and *how long* it takes

Uroflowmetry is used to assess how well a patient's **bladder and sphincter** are functioning and to check for **obstructions in the urinary tract**

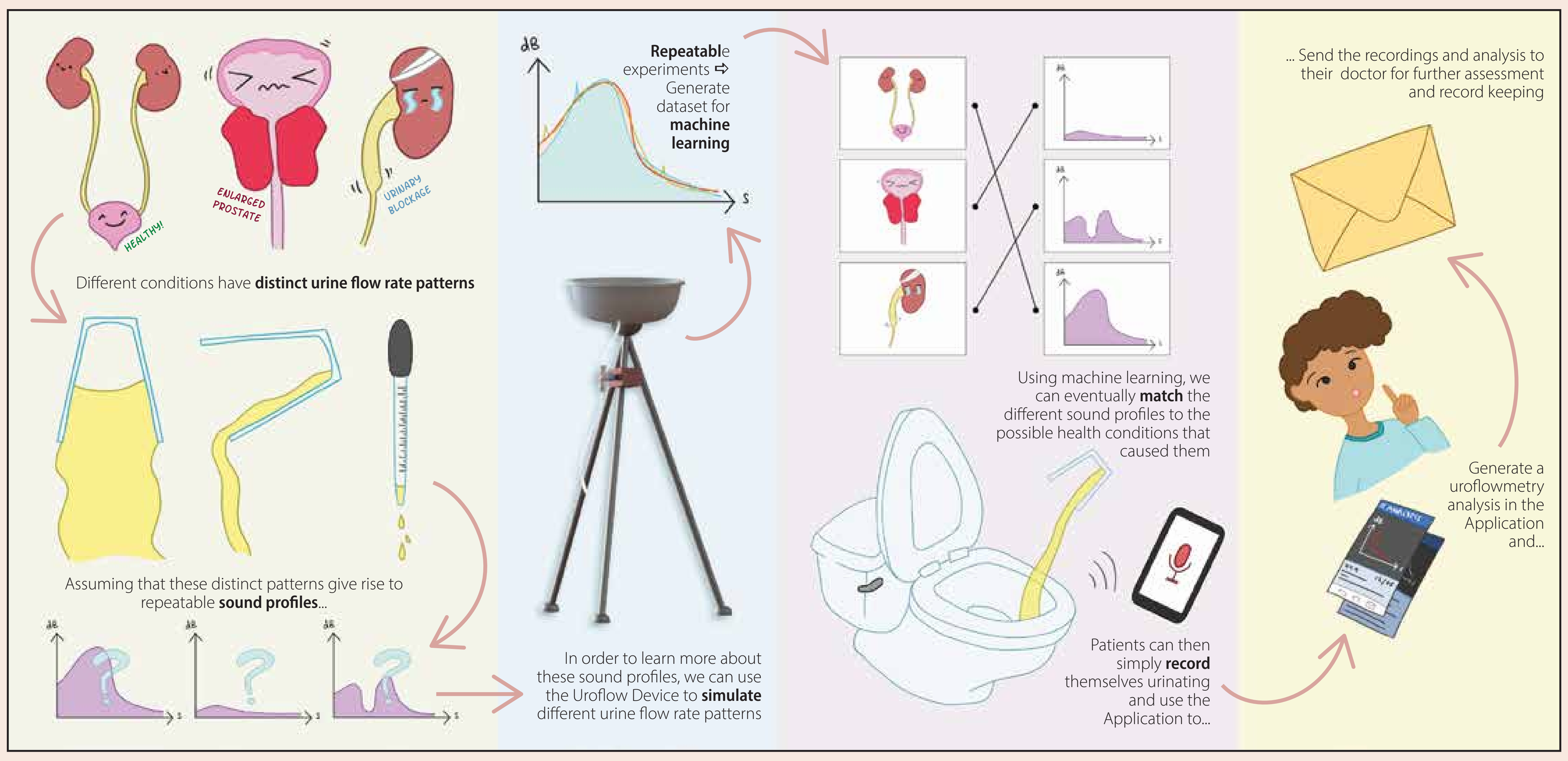
**Conditions** that can affect a patient's normal urine flow include enlarged prostate, bladder cancer, prostate cancer and urinary blockage

## Uroflow Device: *The Problem*

Currently, uroflowmetry involves the patient urinating into a funnel connected to an electronic uroflowmeter

The electronic uroflowmeter consists of a ***highly precise weighing scale*** and ***specialised recording equipment*** ➪ **Expensive** and **difficult** to use ➪ **Not practical** for ***frequent*** tests ***at home*** + Less developed countries **lack access** to uroflowmeters

## Uroflow Device: *The Solution*




## Main Project Results

### ▸ Project Aim

Pocket Stethoscope aims to amplify sounds of internal organs in the body, such as that of the heart, lungs, abdomen and major blood vessels and hence, we will be focusing on amplifying sounds that are within the frequency range of **100 - 2000 Hz**

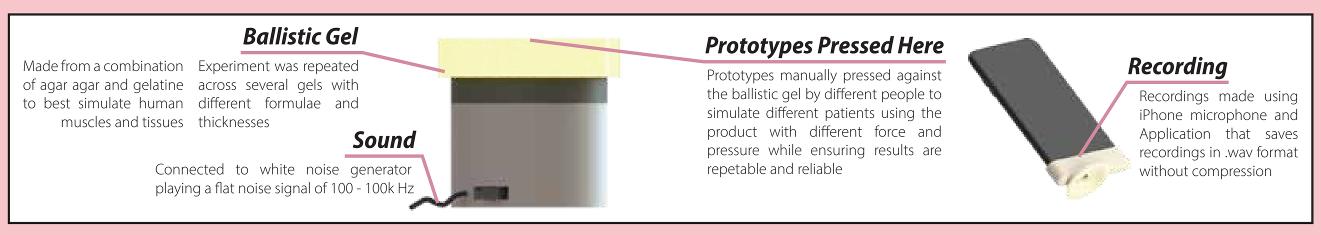
We aim to create a 3D printed stethoscope sleeve for smartphones that is cheaper and more accessible than current available products

### ▸ Current Available Products

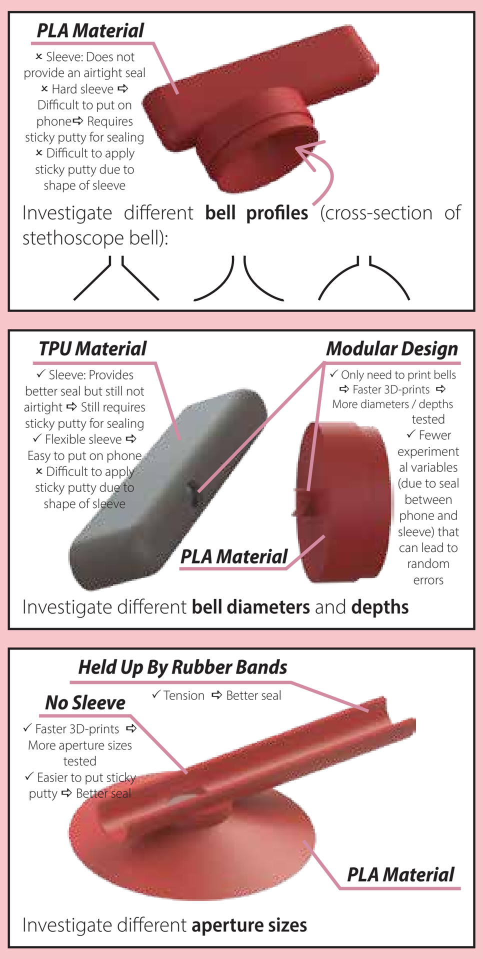
**Steth IO** is an existing product available on the market which allows patients to examine their own heart and lung sounds at home

Steth IO is a metallic phone case which costs **USD 200**, making it **unaffordable** and **impractical** for many patients, especially if they already face poverty and / or large amounts of hospital bills

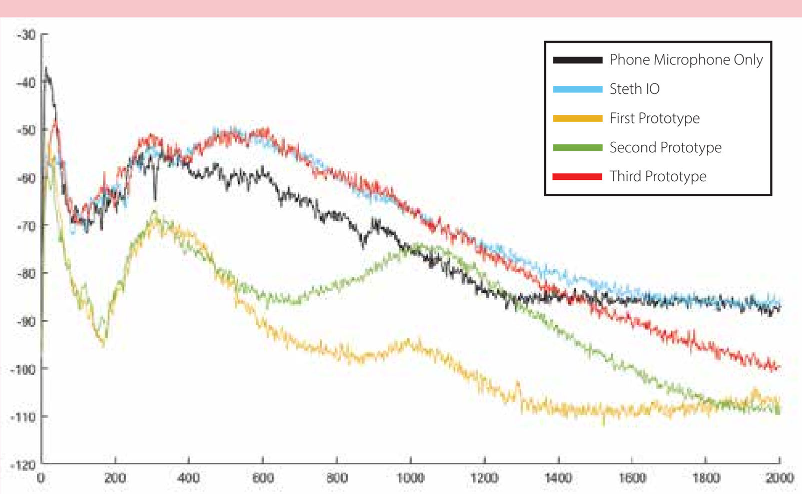
### ▸ Experimental Set-Up




### ▸ Prototype Iterations




### ▸ Experimental Results and Analysis




#### What is FFT?

Fast Fourier Transform (FFT) takes a signal and decomposes it into the pure frequencies that make it up

Hence, the FFT graph shows the sound intensity (dB) of the recordings at various frequencies (Hz)

This allows us to analyse which range of frequencies is best amplified by the different products and the level of amplification

The graphs are generated using the average measurements of multiple recordings

The major changes made to the First, Second and Third Prototypes are represented by the figures on the right, numerous prototypes with minor changes were made but only the best performing prototype of each iteration are showcased in the graphs and figures

## Main Project Results

### ▸ Project Aim

Construct a motorized flow control device that can be used to simulate different urine flow rate patterns

The UroflowDevice has to be **silent**, **accurate** and **responsive**

### ▸ Challenges

In order to be accurate and responsive, a powerful motor is required to rotate the water valve, however, these motors tend to be **noisy**

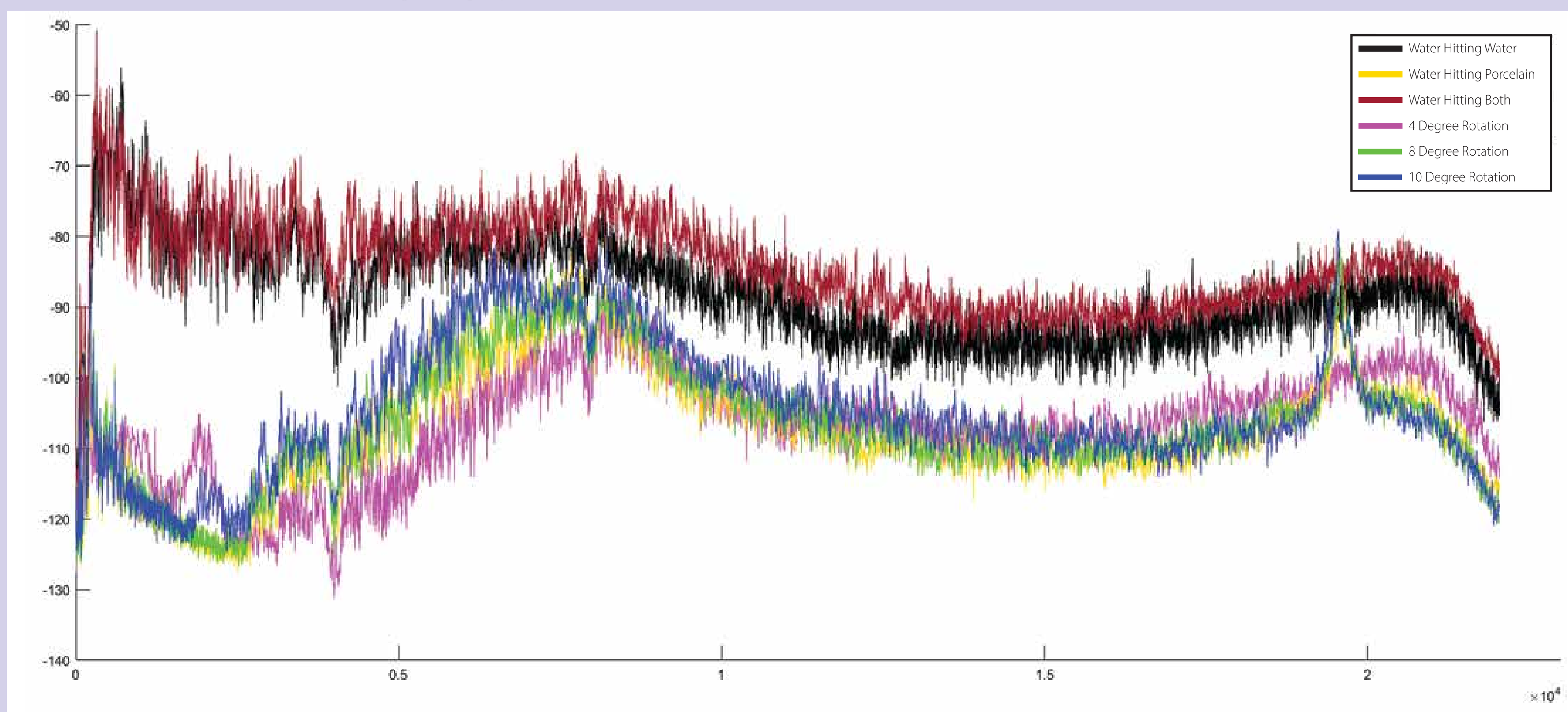
### ▸ Solution

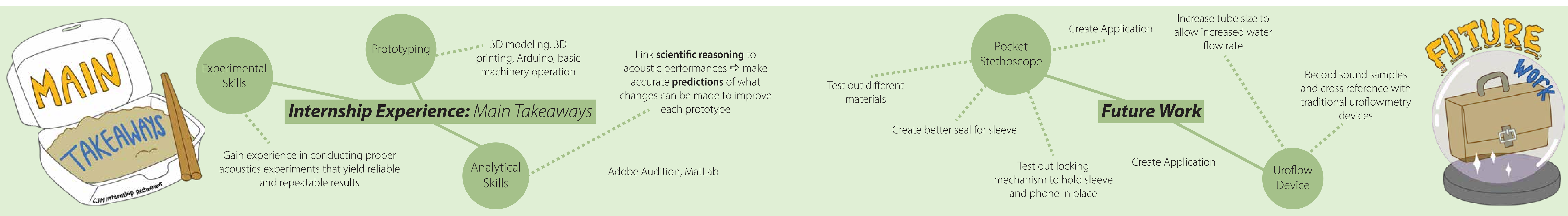
Much of the project effort went into recording different iterations of Uroflow to find better ways to **minimize the noise** from the motor

In order to best minimize the noise from the motor, we compared **different acoustic foams** and characterised the sounds generated by **different motors** from **different angles**

Upon choosing the preferred motor and Uroflow Device set-up, we also discovered that the motor made much less noise when the **degree of motion was reduced** (e.g. the motor turning 10 degrees nine times instead of turning 90 degrees at once)

This can be observed in the following FFT graph:

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