# ‘Smart City Project Programme 18-19’ Briefing Session

## 2017/18 Winning Teams’ Experience sharing


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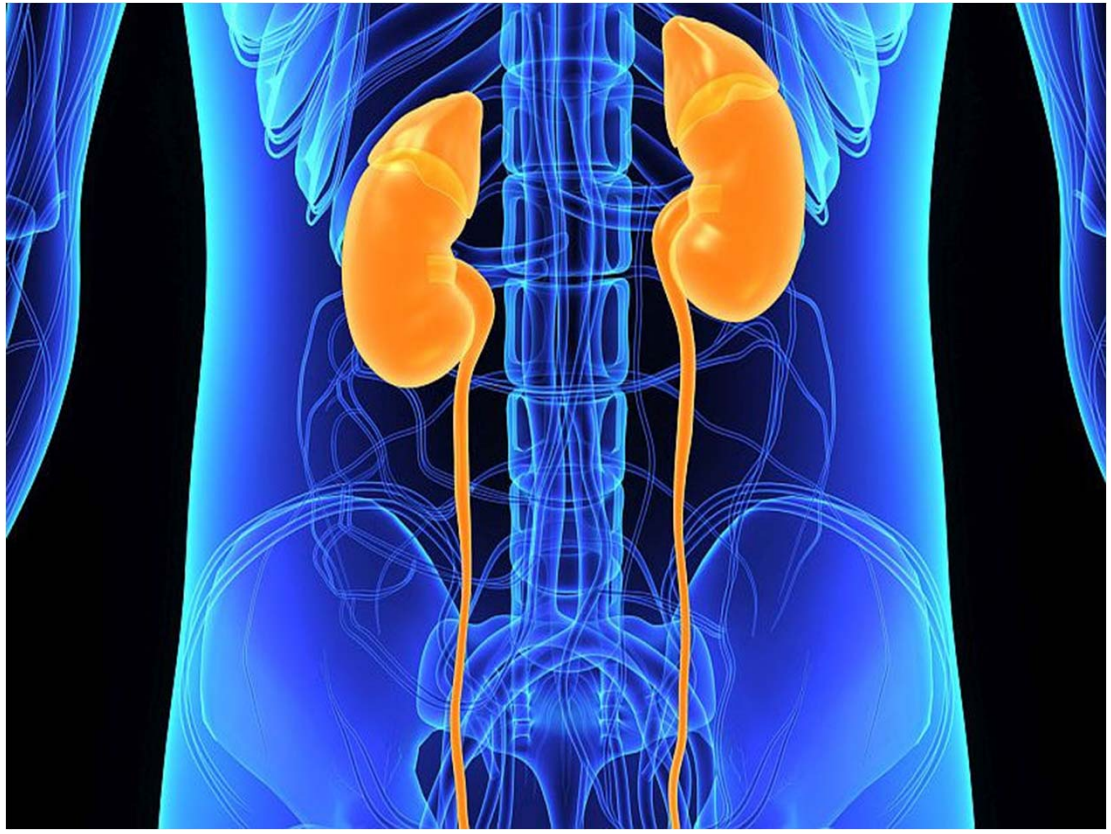
可人教人 All Are Educable

# Problem – Elderly with kidney disease



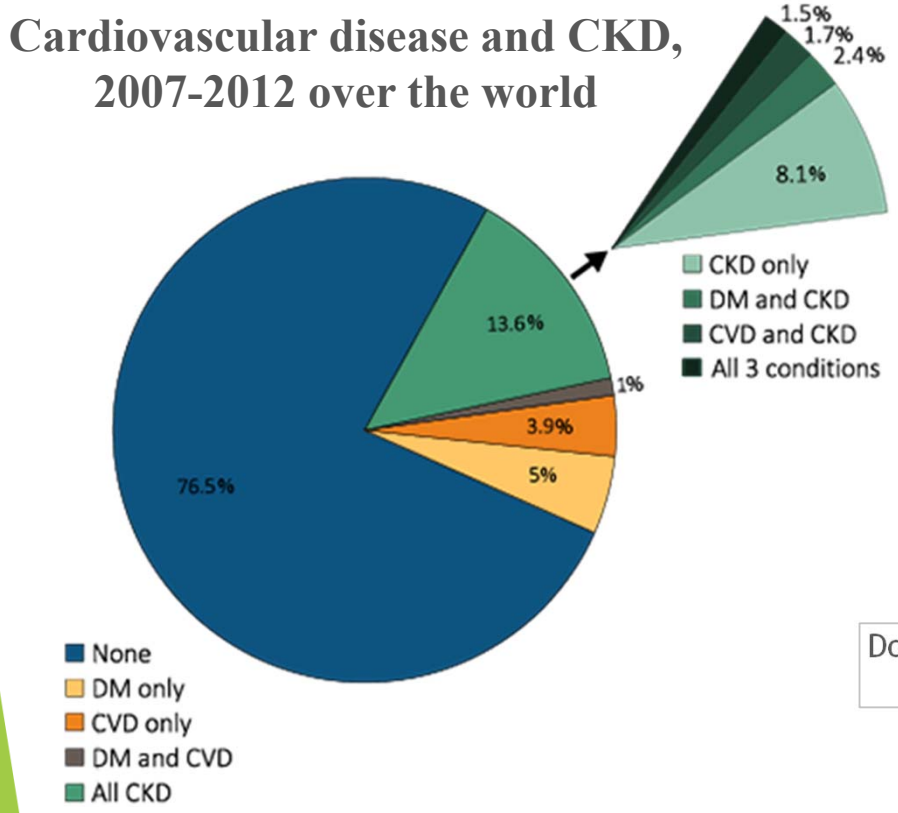
# Problem –Late detection leads to dialysis

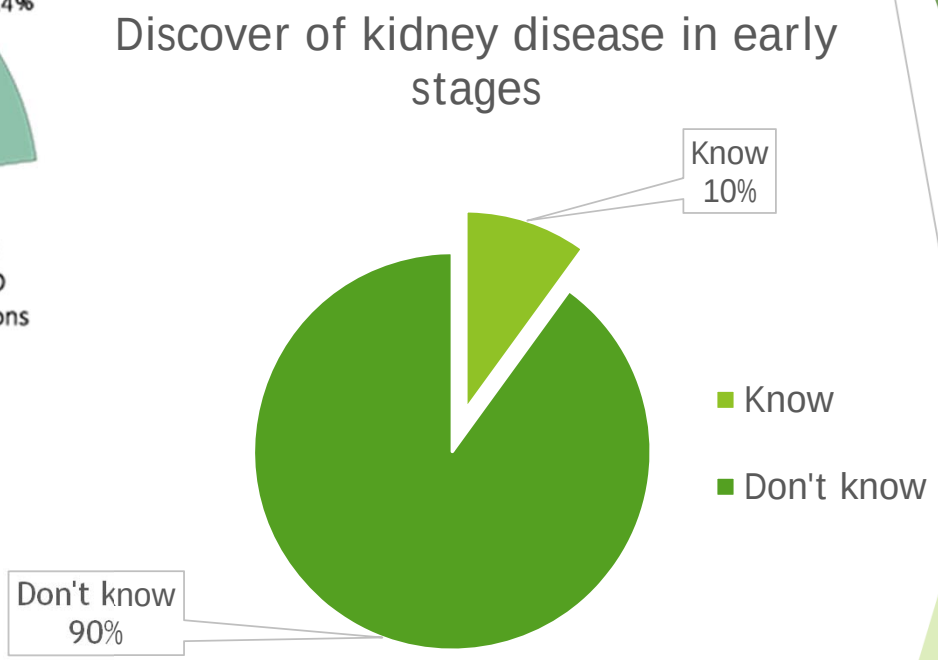
# Purpose

- Help high-risk elderly to assess the condition of the kidney before symptoms and reduce deaths by kidney disease.

# Our solution

# Background




Abbreviations: CKD, chronic kidney disease; CVD, cardiovascular disease; DM, diabetes mellitus

[1] World Kidney Day: Chronic Kidney Disease. 2015; http://www.worldkidneyday.org/faqs/chronic-kidney-disease
[2] Levey AS, Atkins R, Coresh J, et al. Chronic kidney disease as a global public health problem: approaches and initiatives - a position statement from Kidney Disease Improving Global Outcomes. Kidney Int. Aug 2007;72(3):247-259.

# Diagnosis Indications

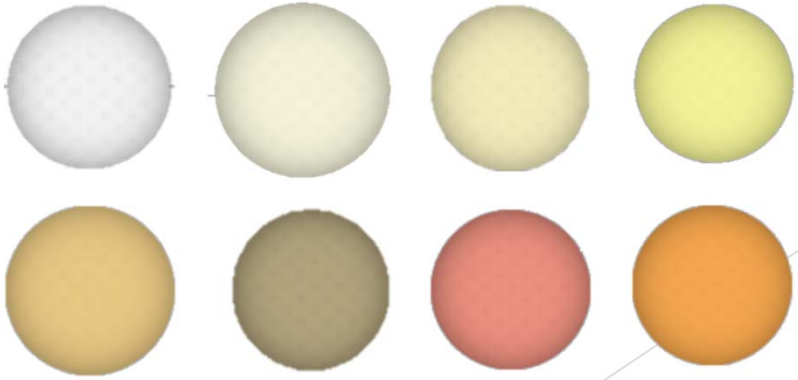
- Urinary output

Normal range
0.8L – 2L

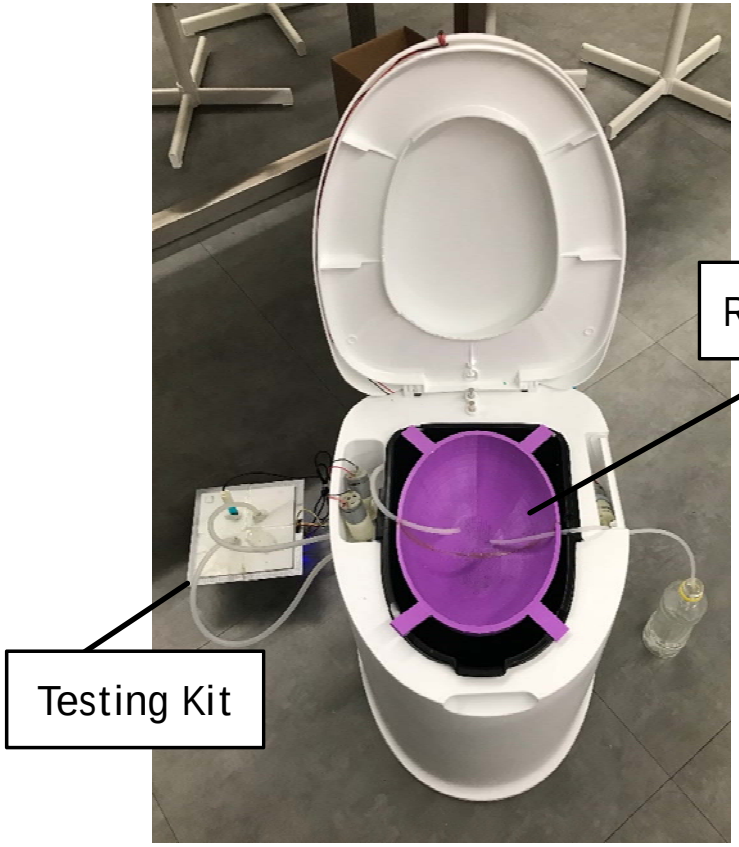
- pH

Normal range
5.5 - 7

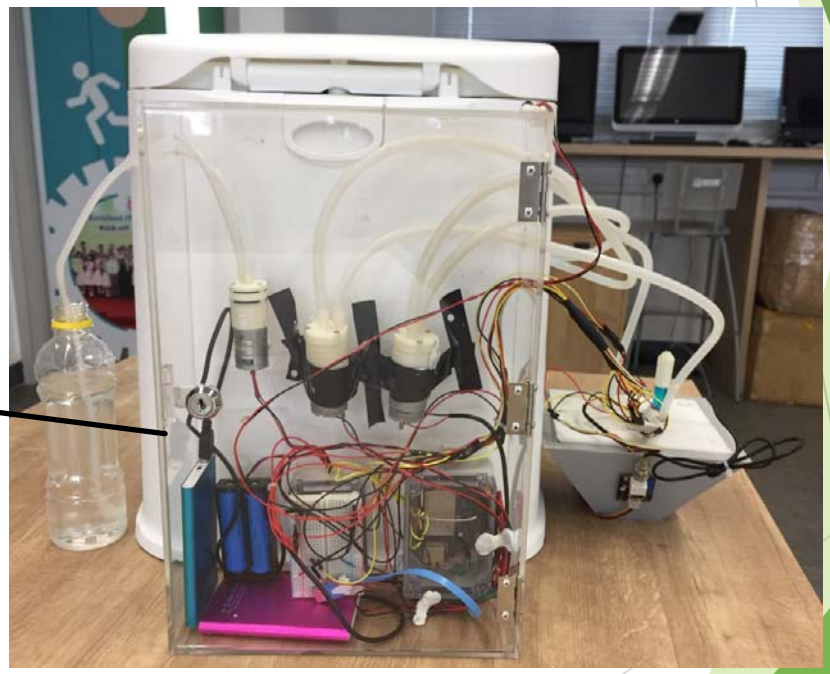
- Color



# Overview of the toilet set up

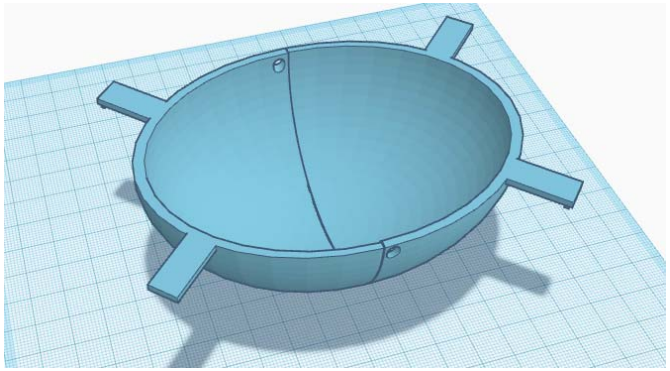



Top view

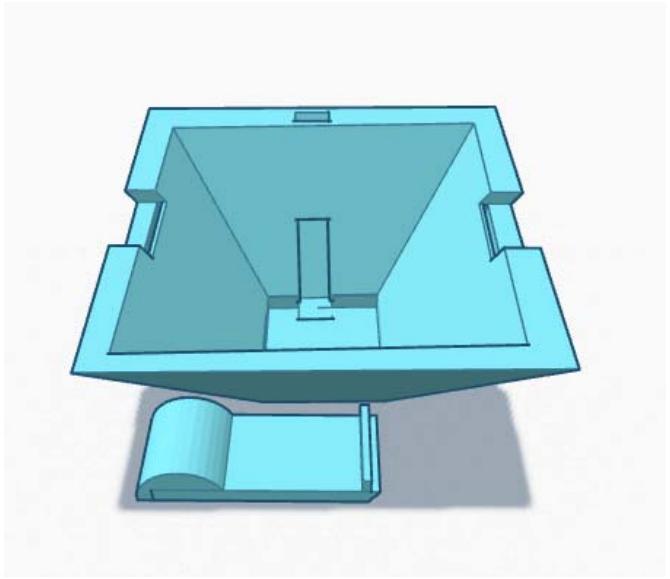



Back view

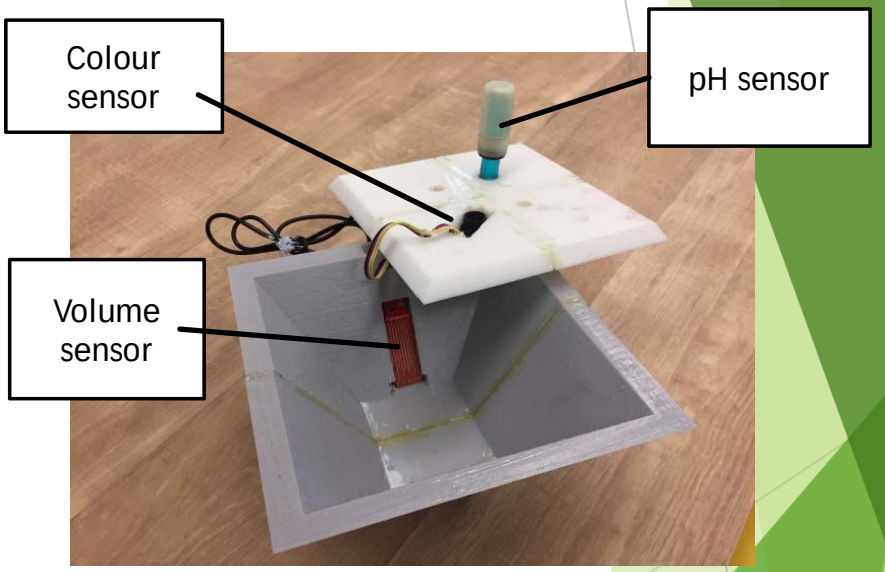
# 3D-Printing Model



Reservoir

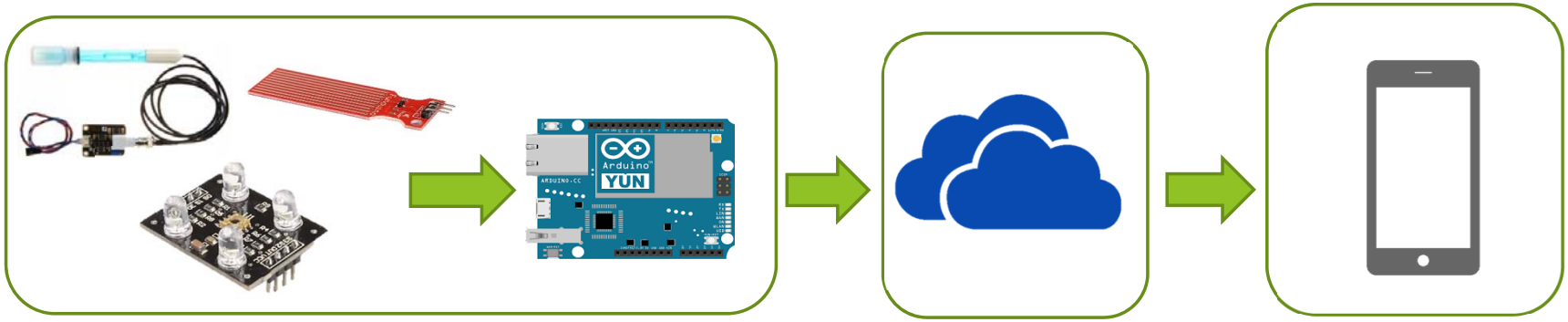


Testing Kit




Urine testing Kit

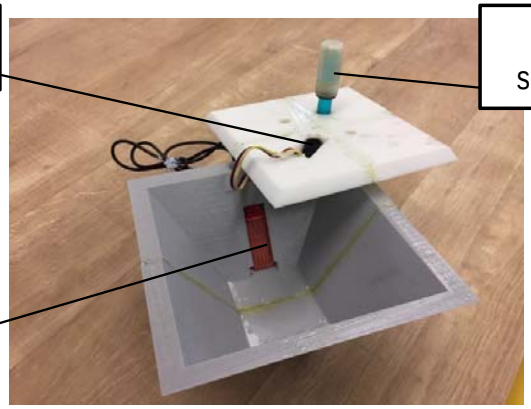
# Configuration



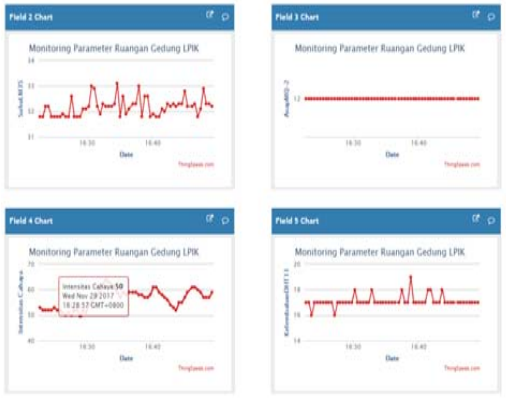

Colour sensor

pH sensor

Volume sensor



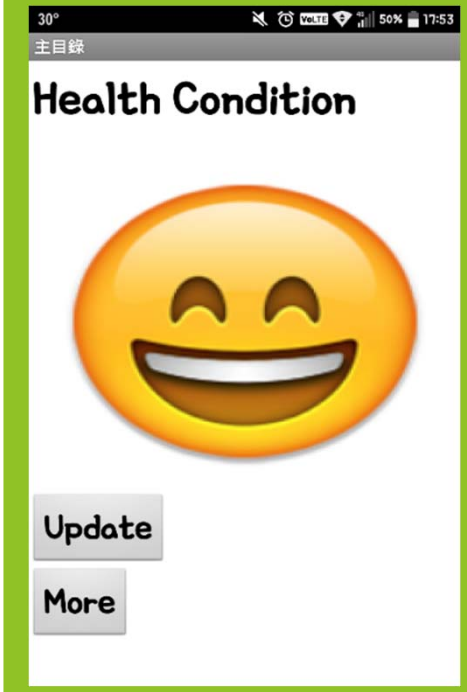
Urine testing Kit

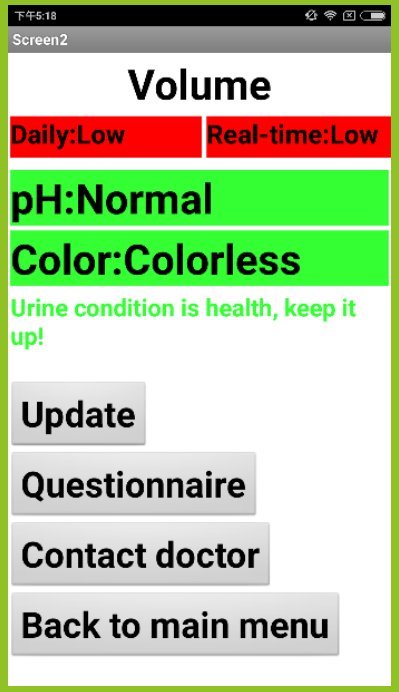



IoT Platform - ThingSpeak

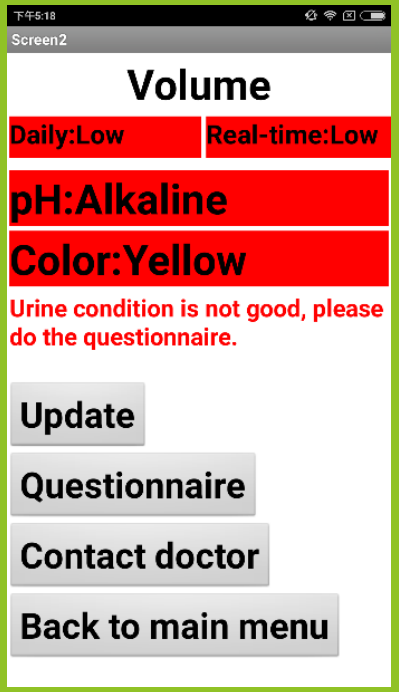

Mobile App

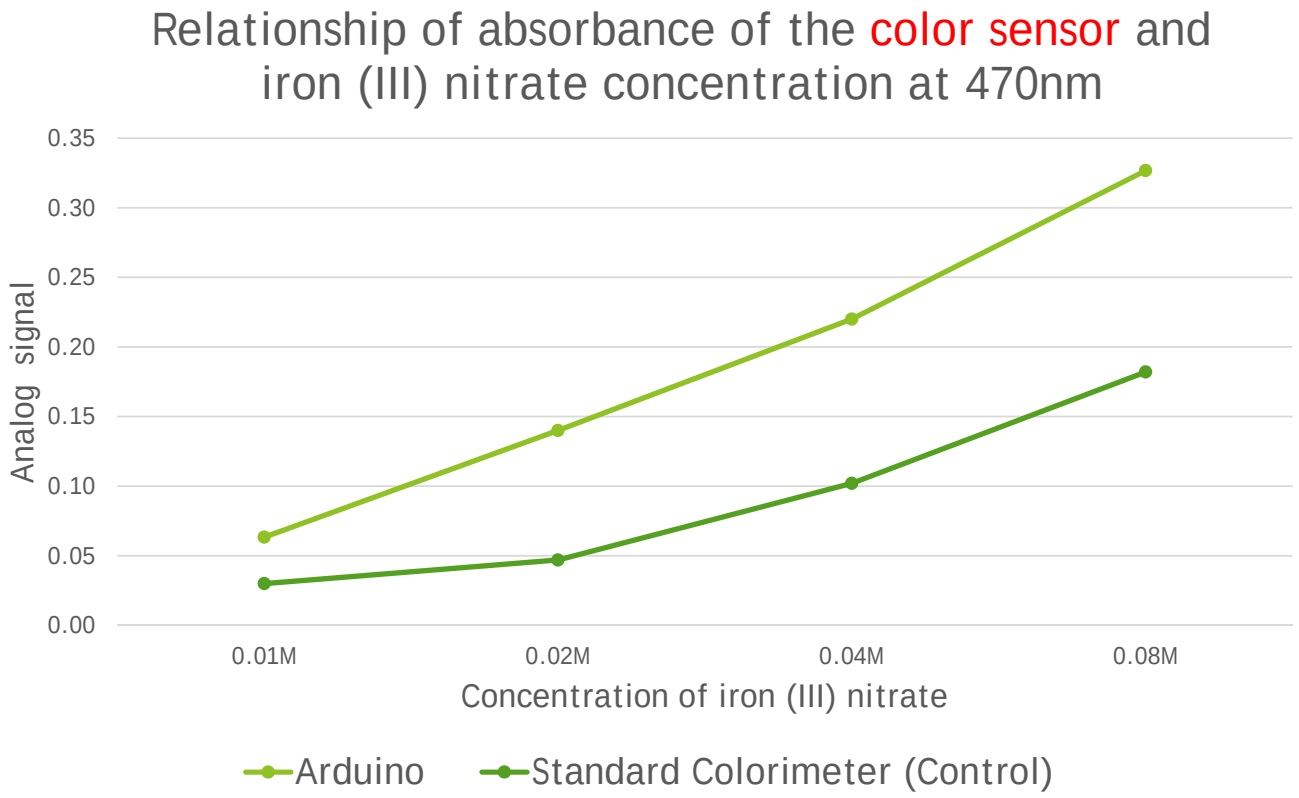
# Display of Results



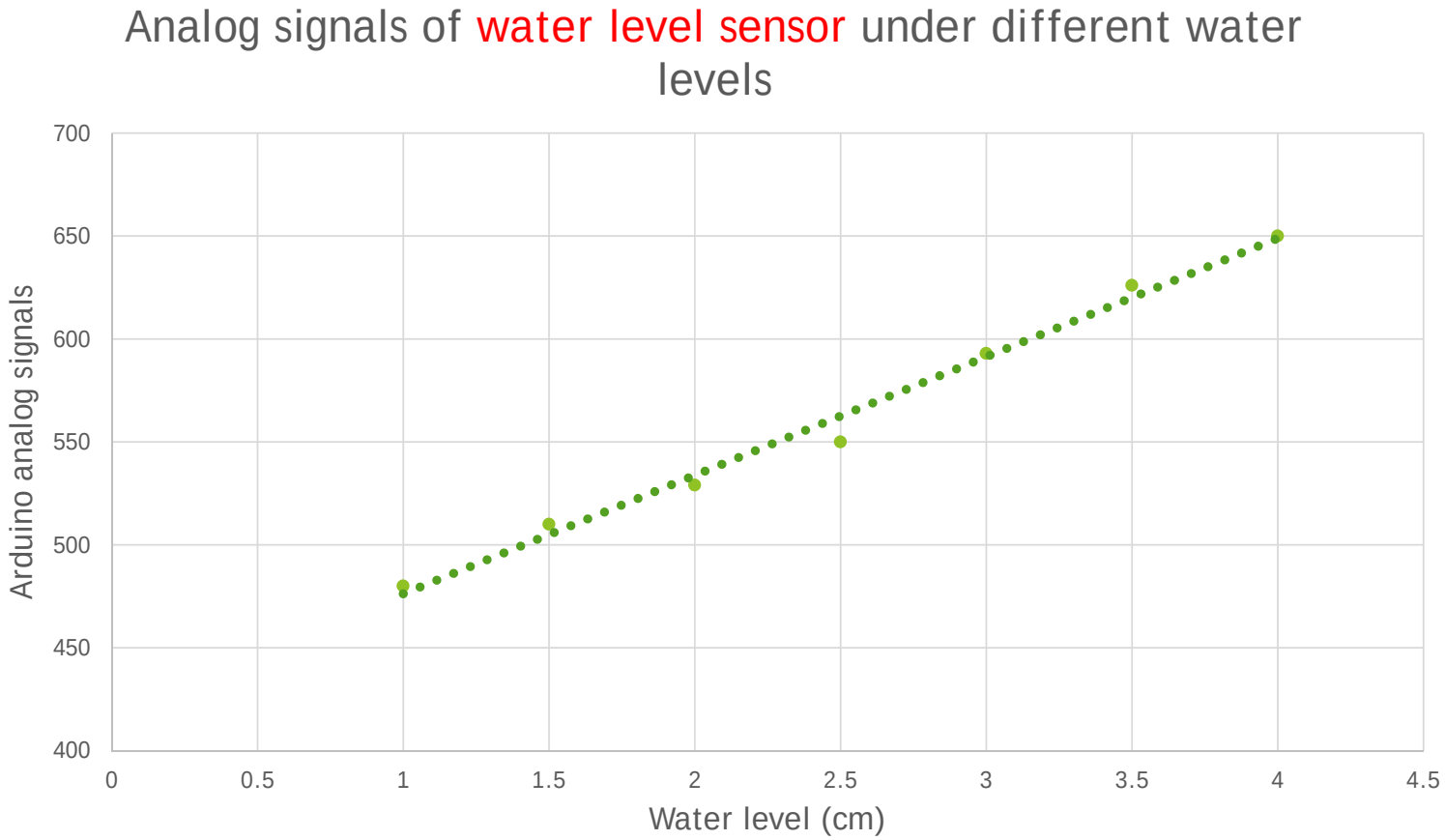










The Arduino color sensor and standard colorimeter shows linear relationship in different level of iron (III) nitrate concentration.




The water level and the analog signal shows linear relationship.

# pH Sensor

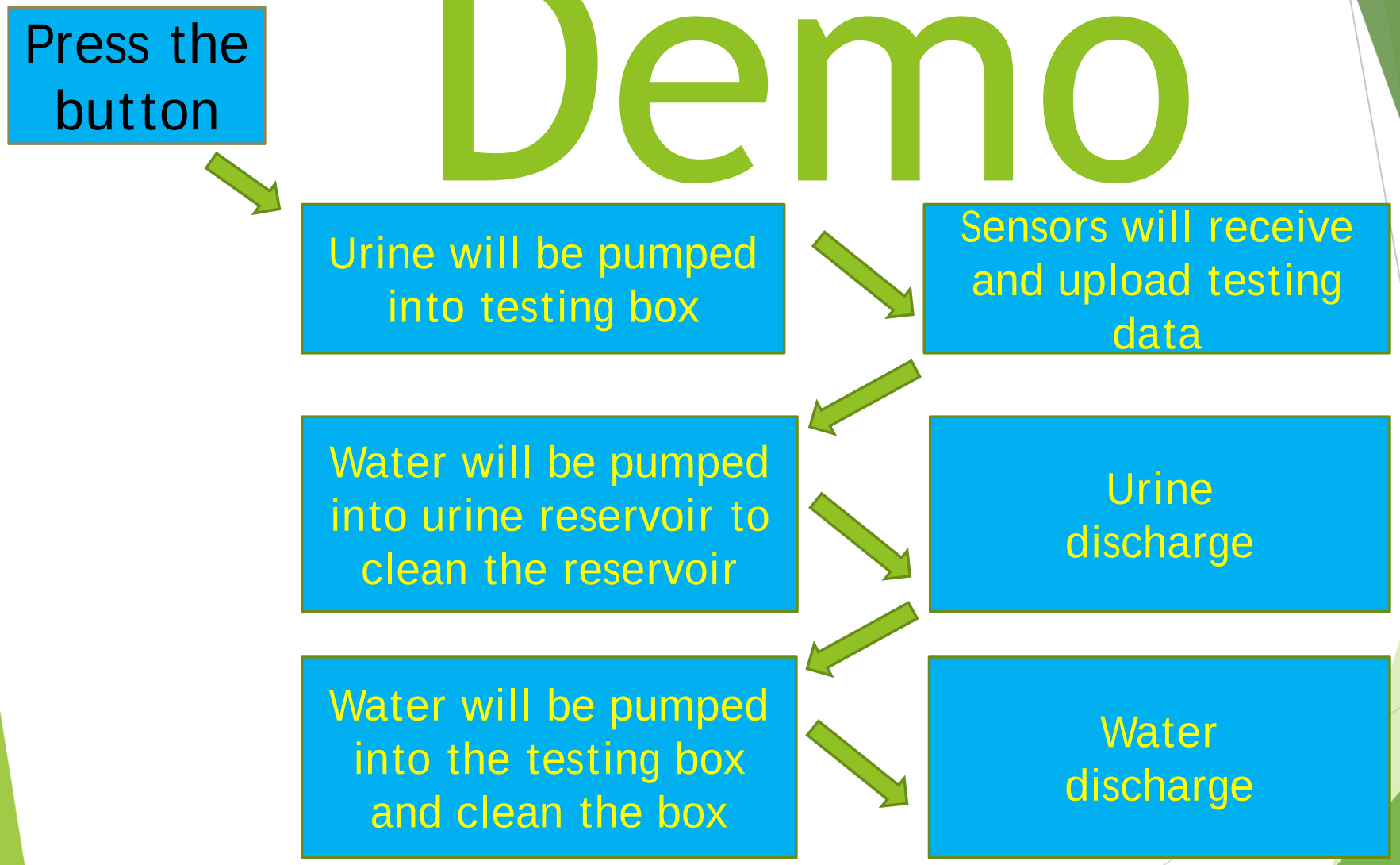
| pH value of standard buffer solution | 3 | 4 | 5 | 7 | 9 | 10 |
|---|---|---|---|---|---|---|
| PH-206 | 3.01 | 4 | 5.04 | 7.01 | 8.84 | 9.99 |
| % Error | 0.33 | 0 | 0.8 | 0.14 | 1.78 | 0.1 |
| Our Sensor | 2.89 | 3.87 | 5.01 | 6.88 | 9.12 | 10.23 |
| % Error | 3.67 | 3.25 | 0.20 | 1.71 | 1.33 | 2.30 |

The % error of between pH-206 and our sensor is less than 4%.

# Advantages

- User-friendly & convenient
- Provides continuous data monitoring
- Low cost

# Demo

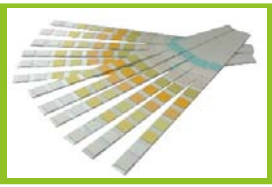

Press the button
Urine will be pumped into testing box
Sensors will receive and upload testing data
Water will be pumped into urine reservoir to clean the reservoir
Urine discharge
Water will be pumped into the testing box and clean the box
Water discharge

# Cost evaluation

| Microcontroller | pH meter | Color meter | Water level sensor | Pumps | Waterproof box | Installation |
|---|---|---|---|---|---|---|
| $20 | $15 | $8 | $1 | $6 | $20 | $10 |

TOTAL US$80

# Comparison with commercial available products and services

| | KIDNEY |  |  |
|---|---|---|---|
| Cost | US$80 | US$2 /test | US$200 /test |
| Feature | • Accurate<br>• Fast<br>• Quick and easy installation<br>• Home-checking<br>• Convenient<br>• 24/7 data that can be shared with doctors<br>• Multiple use | • Disposable<br>• Difficult to read and understand the result<br>• No online platform to share and store data | • Expensive<br>• Need to stay in the hospital for observation |

# The Next Step

- Have multiple sizes
- Measure urine glucose and protein
- Promote to elderly centres