

CHAPTER 6

INSAN SMART ACID BASES TITRATION SYSTEM

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ABSTRACT

Titration method is one of the common laboratory methods used to determine the quantity required by acid or alkali to neutralize, an important experiment in schools as well as higher learning institutions. For example, should you have an unknown concentration of acid (titrand/ analyte) you would need to perform a titration process to determine the concentration. But first, you must have a titrant, or known concentration of alkali which is placed in a burette. The amount of volume required to neutralize the acid can be determined by the burette. You are going to need a few drops of indicator known as phenolphthalein to know that the neutralization point has been achieved. At the neutralization point, all the acid has been neutralized by the alkali. The solution of the acid will turn from colorless to purple. Once it becomes purple, titration is to be stopped and volume consumed is recorded. Having the consumed volume, concentration and neutralization chemical equation, you can easily determine the concentration of the unknown acid. Although the Titration method looks easy, there is a challenge. We make this project because we found out that it is very difficult to detect quick changes of colorless to purple through human naked eye observation. Over titration is always haunting the experimenter. Thus, we have created Insan Smart Acid Bases Titration System through implementation of SAM Labs Kit into titration set up. Through this system, the result will be more consistent and repeatable because the detection is more accurate and consistent and the system is automated. This could help students and researchers in their experiments and research both at schools and higher learning institutions.

Key Words: Automation, Titration, System.

1. INTRODUCTION

One of the more tedious processes in experiments and research is the repeating process which includes the titration process. Even though the titration method looks easy, the problem arises when it comes to human limitations such as difficulties of the human naked eye observation in detecting quick color changes that occur during titration. Therefore, the Insan Smart Acid Bases Titration System is created through implementation of mechanical automation with titration set up to create an automated titration system that is reliable and consistent for recurring tests. It is aimed for students and researchers in their experiments and research both at schools and higher learning institution. It is able to assist in titration method, making the process more accurate and less time consuming. To make this project a reality, we have conducted experiments and tests using a prototype. This prototype is created by combining titration set up with the SAM lab kit.

2. LITERATURE REVIEW

Titration method is a technique in which a known concentration is used to determine the concentration of an unknown solution. End point of the titration is when the point during a titration when an indicator shows that the amount of reactant necessary for a complete reaction has been added to a solution. There are four types of titration methods such as Acid-base titrations, Redox titrations, Complexometric titrations and Precipitation titrations. The simple technique of titration is by using sodium hydroxide and phenolphthalein as indicator.

3. METHODOLOGY

3.1 Materials and apparatus

Phenolphthalein, burette, 0.01M of Sodium Hydroxide solution, NaOH, Retort stand, Stirring hot plate, magnetic stirrer, portable lamp (light source) and SAMLAB Maker kit.

3.2 Apparatus

The apparatus for the titration set up was done as shown in figure 1. Using a pipette, sodium hydroxide solution was transferred into a conical flask. The burette was clamped vertically on the retort stand. The conical flask containing sodium hydroxide solution was placed on top of the hot plate at the base of the retort stand. The light source was placed behind the conical flask. The light sensor was placed opposite the light source in front of the conical flask. A few drops of phenolphthalein indicator were added into the sodium hydroxide, NaOH solution. The solution was stirred by using a magnetic stirrer so that both solutions mix well. Hydrochloric acid, HCL, was added until the colourless colour of the solution changes to purple (titration point is met). The tap was returned to its original position by the aid of a servo motor (prototype) when the titration point was met.

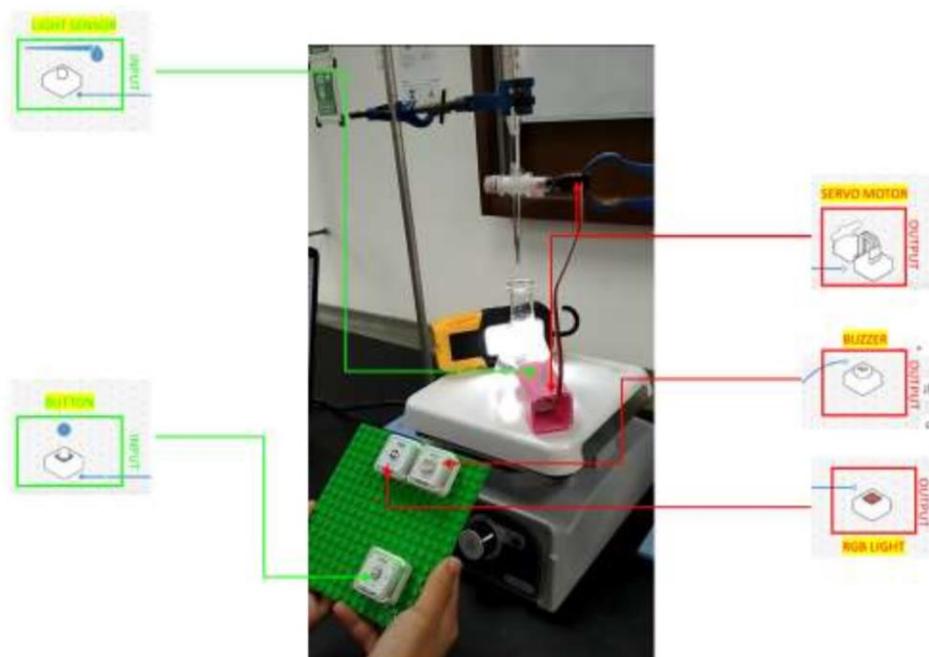


Figure 1 placement of sensors on the apparatus

4. RESULTS AND DISCUSSION

Referring to Figure 4, the click on the button sensor triggers the toggle (switch) to turn on the servo motor connected to the burette stopcock and the alkali solution will start dripping slowly. The angle set is 37° , less or more will lead to non to too slow dripping or continuous flowing which we do not want in titration.

The light sensor is detecting the solution brightness. The intensity is constant and the value is fixed to 95 by exposing it to a bright light source. When the color changes to purple, the light intensity will drop instantly and less than 95. When it catches less than 94 (<94), the titration point is met. This compare behavior will send a stop signal to the trigger (switch) behavior to return the servo motor to its original position. There is a compulsory hold (time) behavior to secure the servo motor in position. The system can be reset by clicking the button sensor again. The titration is complete. The complete description is shown in Figure 5.

The very common application of titration process in schools and higher learning institutions potentially creates a high demand for the Insan Smart Acid Bases Titration System in the market. At the same time, the simplicity of the system which only includes sensor and servo motor makes it low cost, thus easily affordable by school students. In addition, it also does not need any complicated maintenance and does not run by consumable material thus the user is not burdened by repair costs or limited material.

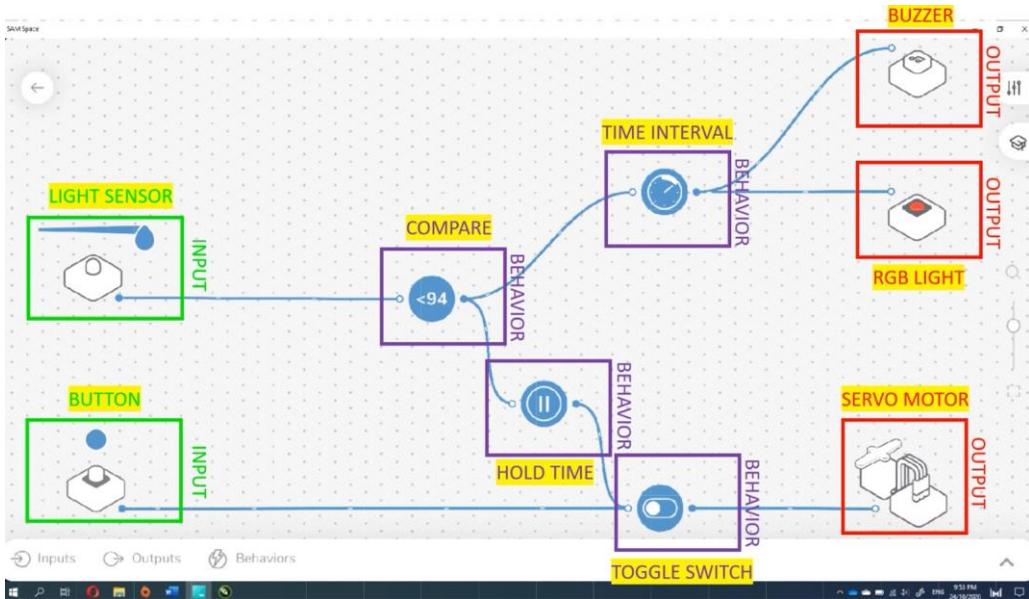


Figure 4 Operating sensors for the system

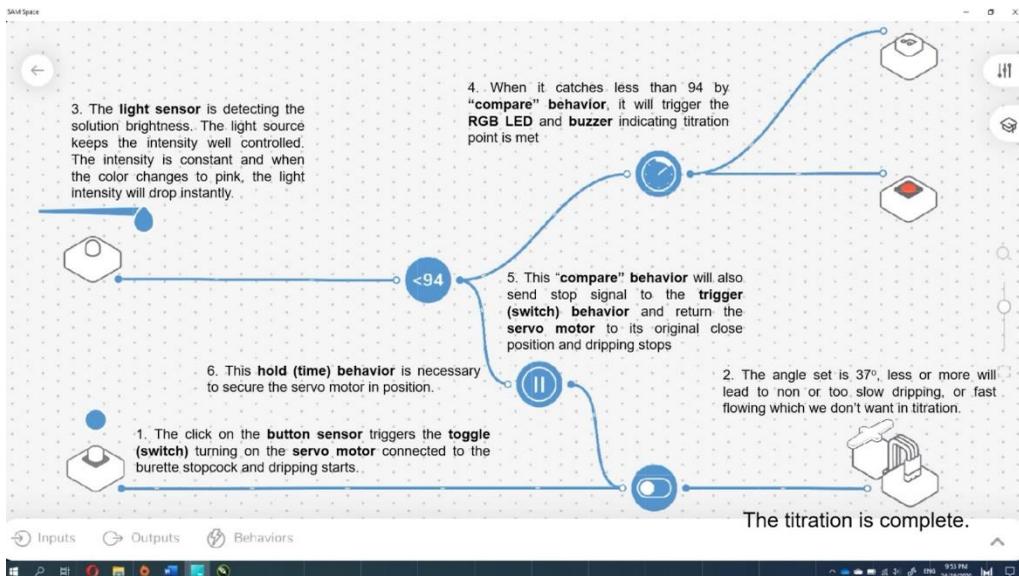


Figure 5 Description of each sensors functions and behaviours

5. COMMERCIAL VALUE

The autotitration system improves the accuracy and repeatability of titration experiment. It requires less manned operation. It has simple automation part without the need of complex maintenance and low frequency of moving part replacement.

6. CONCLUSION

In conclusion, the Insan Smart Acid Bases Titration is a reliable tool to make the titration process more accurate and less time consuming. We hope that this system not only assist in the titration method but is also able to inspire and motivate other students towards learning and implementing science and technology.

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