Lab Kit for Liquid Level Measurement Using Valve Opening

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ABSTRACT

Liquid monitoring and storage in tanks are major problem in many industries. Since this process required accuracy and controller to control the liquid level in coupled tanks. The main aim of this project is to develop a lab kit liquid level measurement using valve opening with PID controller. The PID controller in this paper will be examine in order to develop and build a coupled tank liquid level control system. This system method results, and simulation is obtained from the LABVIEW software. The LABVIEW simulation of the PID controller is done to observe the behavior and the performance of each of the PID parameters. The transfer function will be obtained by considering some factors such as diameter and area for both tanks, volumetric flow into the first tank, volumetric flow rate from first tank to the second tank, and the height of liquid level for both tanks. After that the equation for each factor will be found then the Laplace transform is applied to obtain the final transfer function of the system. In this paper, the graph simulation results for each PID parameter will be done to recognize the best values of the performance of the PID controller. A servo motor will be utilized to control the valve position. An ultrasonic sensor will be utilized in this system to measure the level in the lower tank. The propose system interfaced LABVIEW with Arduino Uno to control the servo motor through LINX library in LABVIEW. The propose system observation done in different components. It was observed the servo motor maximum rotation was 175 degree. Other observation was in reading the water level where the minimum 3cm the ultrasonic can detect. The differences in terms of the system performance either with PID or without PID will be discussed.

Keywords: PID, Couple tank system, Control system, LABVIEW software, Lab kit.

1. Introduction

Mostly in process industry, controlling liquid and flow between tanks is a primary problem. The tanks however are regularly combined and thus levels interact and thus tanks should be controlled regularly. Besides, controlling the level of liquid is an essential in chemical systems as these systems constantly deals with levels monitoring and controlling. In addition, these systems can be effectively controlled with the use of PID controller. Through industrial processes, PID controllers were widely utilized. Similarly, PID control is consider the easiest and efficient approach for many issues that occur in the industries. In fact, the development of PID control was in 1910[10]. Despite technological developments, the automated control scientific knowledge today offers a wide range of control systems. Nevertheless, most industrial controllers often incorporated through PID algorithms at low rates, while the same Applicability, good flexibility, usability and ease of use could not be seen with other controllers than the PID controller.

PID control is utilized when the demand of accurate levels controlling are required. The set – point can be obtained since the PID controller incorporates three control parameters to obtain one output. Similarly, the output in PID control can be obtained in a way of getting the differences between the set point and the initial value. The PID has a proportional bandwidth which seeks to achieve the process value mostly in a least amount of time, without prolonging the oscillations[1]. In addition, when the band is set too high, maximum power is lost when a significant error remains present and thus the setting point would not be achieved. on the other hand, when the band is small, the power is kept before the process value is equal to the setpoint and thus the overshoot would be large. While the small band is tried to adjust itself, power may be turned on and off. This creates oscillations across the set-point that can require time to settle.

2. Literature Review

In the industrial application of food, medicinal, chemical, water purification, etc., industrial tank system plays a significant role. The couple tank system is one of the common industrial tank systems utilized. The main advantage in using PID was in order to confirm that the liquid flow is at a steady rate. Researchers [7] have built the system based on a microcontroller model design to precisely evaluate and monitor liquid levels to enhance motor pumping performance. ATMEGA32 starter kit board was used to improve the system and to enhance the motor control efficiency. Furthermore, the liquid level of the system was determined by the continuous fluid level sensor and the results were shown with LED display circuit. The actual fluid temperature inside the tank was determined with a temperature sensor. System programming was developed in C-language, interrupt routines were utilized to monitor and process time data to correctly measure the liquid level. In the system design, as mentioned earlier the system consisted of ATMEGA32 microcontroller, 7 segments to show the liquid level, and motor to pump the liquid inside the tank. The purpose of using ATMEGA32 microcontroller was due to its characteristics such as low voltage and high performance. The system involved of two liquid tanks, where the first tank was used to accommodate the incoming liquid while maintaining the difference of the liquid at a chosen requirement. The second tank was utilized as an output to deliver the liquid at a steady level. The e-type sensor was placed at the second tank. When the level of the liquid increases until it maximum which is 25cm the motor pumping will stop operating. When liquid level is at a certain value or to pause the motor under the value, a board control signal will transmit a signal to the motor pumping circuit to prevent idling status. The simulation results of the system were accurate as the e-type sensor measuring correctly the level of the liquid. However, the graphical user interface GUI was not achieved and developed in this system. Controlling the degree of opening and closing the valve were not included. The system can be further improved by adding another functionality such as accessible via SMS.

Researchers [14] have proposed a research to enhance and develop a liquid level in a couple tank system. For almost all process industries, traditional PID controller was used to control the chosen set point. A mathematical model of this research of the first order tank system was found. The system contrast of the different setpoints provided to the system was conducted to show the Gain Scheduling PID with Back Calculation Integrator Antiwindup surpasses the conventional PID controller. Gain Scheduling Controller was utilized to develop the system. The tank systems design is composed of a crossbar-shaped tank. The system block diagram as shown in figure 2.2, contains of three main sections, the standard PID system, added by the Back-Calculation Integrator Antiwindup to avoid volatility, and the Gain Scheduling to improve output in the wanted operating condition. according to the results obtained, Scheduling PID is the enhanced of standard PID controller. However, in this research the results obtained were not displayed through GUI. Thus, this limitation could lead to not fully understanding the system.

Researchers [8] have proposed a research to develop a liquid level control system. In process technologies the liquid control is the main concern as it required to monitor the liquid level in couple tanks. However, the PID controller in this research was examined in order to develop and build a couple liquid level control system. This system method results, and simulation were obtained from the MATLAB software. The Simulink model of the PID controller was created to observe the behavior and the performance of each of the PID parameters. Similarly, by utilizing this software, the overshoot, rise time, steady state and settling time were tested and observed to evaluate and enhance the system. The transfer function was obtained by considering some factors such as diameter and area for both tanks, volumetric flow into the first tank, volumetric flow rate from first tank to the second tank, and the height of liquid level for both tanks. After that the equation for each factor was obtained then the Laplace transform was applied to obtain the final transfer function of the system. In this paper, the graph simulation results for each PID parameter were done to recognize the best values of the performance of the PID controllers. However, the PID controller removes the proportional mode offset and gives fast response. This system utilized to monitor the water level within a tank under any process situation. The PID algorithms will respond to the system so that near the set point the system is stabilized. Nevertheless, this system still has some limitations. The research results obtained with no (GUI). However, controlling the degree of opening and closing the valve were not included as the valve operation was only act as ON and OFF.

Trinh [17] has proposed a research to develop the design of couple tanks liquid level control. Due to the noise in chemical manufacturing that deals with couple tanks liquid control is affected the environment. This paper studied the PID controller with fuzzy which added to the nonlinear dynamic model to the system of couple tanks, and with taking consideration of the impact of noise. Thus, this paper analyses the control of conventional PID along with fuzzy logic method for nonlinear model of the system of the liquid couple tanks. Based on the Ziegler Nichols technique, the PID controller was developed based on linear model of the coupled tanks. The results were conducted on MATLAB software. The first tank will accept the liquid flow which by pumping the liquid through DC motor. The second tank was connected with ultrasonic sensor to measure the liquid level inside the tank. Between the couple tanks an electronic valve is added to make the liquid flows form the first tank to the second tank. The simulation results show that fuzzy-PID has the highest level of control where no overshot, removing steady error, keep the minimum time constant, and nearly eliminate the effects of disruption compared to conventional PID controllers. However, the GUI was not achieved and developed in this system. A future improvement can be by enhancing the dynamics of actuator and senor, based on actual device to achieve more accurate model of the control device, and serves a better control to the system.

3. Methodology

This section will explain the overall block diagram of the system, where in order to provide full knowledge of the arrangments made to get the overall transfer functtion of the coupled tanks system, the block diagram has been divided into different blocks. Figure 1. Shows the block diagram of the upper tank where the input is qin and the output is q1. The area of the upper tank and the resistance "R" was taking into consideration in order to find the transfer function of the upper tank. similarly, after the substitution was made in the calculation section . The final transfer function of the upper tank is as shown in Figure below.

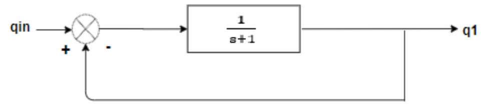

Figure. 1. Upper tank block diagram

After finding the transfer function of the upper tank, the lower tank will have the same transfer function since the same concept was applied to the lower tank. However, from the block diagram shown in Figure 2. The input is q1 as it is the output from the upper tank and the output is the height of the water level.

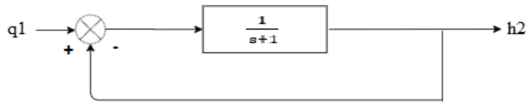

Figure. 2. Lower tank block diagram

After the transfer function of both upper tanks and lower tank were found. The step after was to include these transfer functions to one block diagram in order to show the overall transfer function of the coupled tanks system. Additionally, it can be seen from Figure 3. The input of the block diagram is the set point (desired level) and the output is the water level. Where the input of the system is in cm and in order to be connected to the transfer function block, it must be converted to cm^3/sec. This was achieved by multiplying the level into 1 / R.

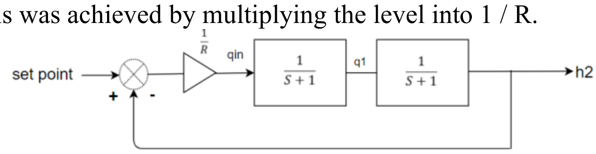

Figure. 3. Upper and lower tank block diagram

The block diagram shown in Figure 4. Illustrates the overall transfer function of the system. This block diagram was tested in MATLAB in order to get the results of the system before applying the PID to the system. As mentioned earlier the input level was converted to cm^3/sec and the output shows the graph of the water level.

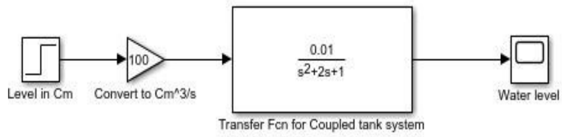

Figure. 4. Block Diagram tested in MATLAB

Figure 5. Shows the overall block diagram of the system developed in order to clarify the system response and knowing the parameters which included in the system. In addition The PID controller was added to control the system performance and processing the error. The system was started by inputting the set point. When the set point is entered, the system will process the given set point and the error will be reducing according to the reading of the level sensor. The reason of controlling the water level in the system is to maintain the wanted water level as required by the set point entered.

Furthermore, the transfer function was found by considering some factors such as diameter, area for both tanks and volumetric flow into the second tank. The system was developed to control the inflow and outflow of the water by controlling the valve position. The valve was controlled via servo motor in order to make the user capable to select the wanted position of opening and closing the valve. In addition, the feedback of the system represents the level sensor where once the level sensor measures the water level to be at the desired. The valve will close gradually to stop the water flow and to maintain the water level at the desired level.

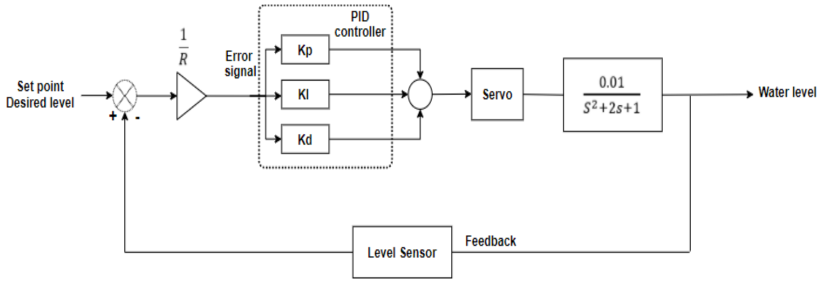

Figure. 5. Coupled tank block diagram

The flowchart of the coupled tank system can be seen in Figure 6. The system is consisting of two tanks, upper tank and lower tank. The upper tank is the storage tank and the lower tank is the tank with level sensor. A pump, ultrasonic sensor, and servo motor are included in the system.

A servo motor was used to act as the valve in the system. where only one valve is included in the system and located between the upper tank and lower tank. The PID control is added to the system to control the degree of opening and closing the valve. The ultrasonic sensor will be used to measure the water level at the lower tank. The system started by inputting the set point (desired level) and inserting the PID parameters. The pump will be turned on to fill the upper tank with water. Where the water at the lower tank will be reduced until it contains 5cm of water then the pump will be turn off. This was done since the pump needed some amount of water at the lower tank to be operated.

After the upper tank filled with water, the pump will be turned off. The step after is to select the valve position. The valve at this point will be fully turn on to fill the lower tank with water. The water level is then will increases and the ultrasonic sensor will read the water level. The PID controller will calculate the error signal and according to the water level, the valve position will gradually be closed until the water reach the desired level then the valve will be fully closed. The system will show the water level graph as the output of the system. the water level graph will rise or decline according to the water level. The system is also allowing the user to select the position of the valve and manipulating the PID parameters to see the system behavior when each of the PID parameters have been changed. This project is developed in this way, since this project is for teaching kit. Furthermore, a bode plot and root locus graphs will be shown in the GUI to further get knowledge of the PID effect on the system. Moreover, the system is providing with an option which can be run with PID and without PID. This was to show that with the PID, the water level matches the set point with no errors.

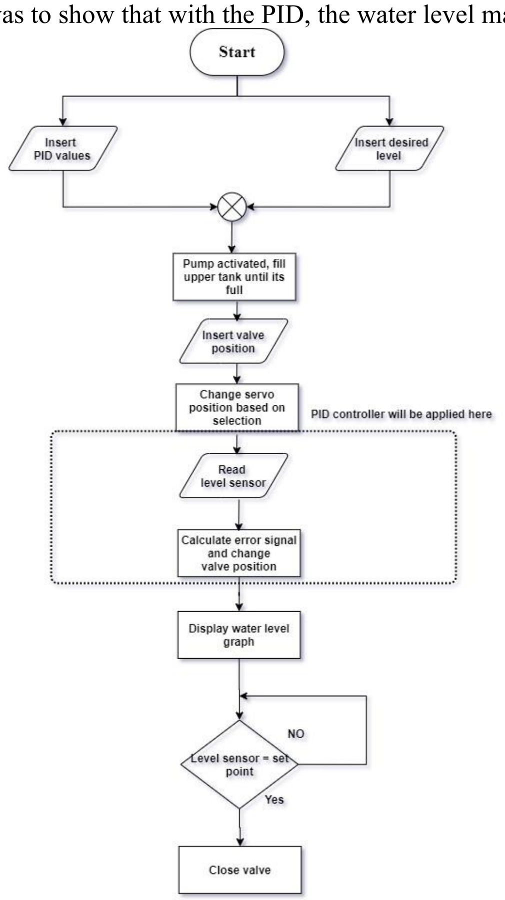

Figure. 6. System flowchart

4. Testing and Result

This section will discuss and explain in detail the system tests which is going to be done to evaluate the system performance and validate the objectives of the system implementation methodology. In addition, the system testing will be divided into different testing methods according to the system components. Such as an ultrasonic will be tested in order to evaluate the actual level and the measured level. The pumps flowrate will be tested according on the time required to fill the upper tank. and lastly the Kp, Ki, and Kd will be tested to evaluate its performance to the system.

4.1 Ultrasonic sensor reading

The water level can be measured by calculating the trip time gap between a transmitted ultrasound pulse and an echo in the checking of the water level control. Water amounts are calculated by translating electronically the time of echo entry observed by the sensor receiver (R) from the transmitter's incident (T) waves. It is recognized that sounds traversed by air at approximately 344 m/s (1129ft / s), and therefore by considering the cumulative time(s) for the round-trip distance(to-and-fro) of a sound wave from the transmitter(T) to the water surface (r) recipient, the ultrasonic sensor can be calculated and multiplied by the airwave(s) of 344ml (or 1129ft /s).

The ultrasonic sensor is fixed on a small plate of wood above the lower tank with one-centimeter height. The ultrasonic sensor has four pins which are VCC, GND, trigger, and echo. Since this system is interfaced with Arduino Uno. The four ultrasonic pins are then connected with the Arduino. In addition, the experimental set up is done by observing the differences between the actual and measured water level and calculating the error. The test of the water level via ultrasonic sensor will be done in different distances. Where an error will be calculated to observe the accuracy of the reading of the ultrasonic sensor as shown in Table 1.

Table 1. Data collection of actual and measured water level

No. of samples	Actual water level in (cm)	Measured water level in (cm)	Error in (%)
1	5	5.211	4.22
2	6	5.720	4.66
3	7	7.300	4.28
4	8	8.131	1.63
5	9	8.832	1.86
6	10	10.133	1.33
7	11	11.333	3.02
8	12	11.901	0.825
9	13	13.322	2.47
10	14	14.120	0.857
11	15	15	0
12	16	16.045	0.281
13	17	17.217	1.27
14	18	18.018	0.1

The implementation of the ultrasonic sensor in the system was done to monitor the water level in the lower tank. As shown in Figure 7. The testing of the water level was done according to the actual level and measured level. Different values were obtained due to the reading of the ultrasonic sensor. In addition, it was observed that the reading of the ultrasonic sensor does not give an accurate result. However, some results were accurate as the level reaches exactly the same actual level.

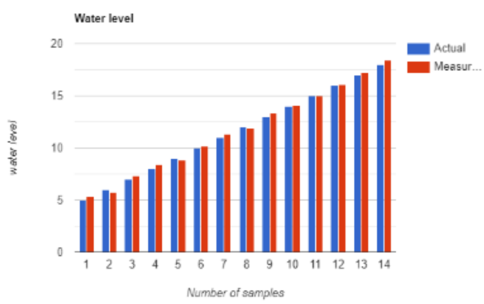

Figure. 7. Water level graph

4.2 Valve control position test

The working principle of which the servo motor is operating is according to the torque moment. torque is also considered the force moment, appears to turn the servo from which it is directed. The torque, as defined in respect of the rotation axis, is proportional to the magnitude of the force vector variable. Notwithstanding its spatial orientation, the vector force may often be positioned in a direction parallel to the axes. In this test the servo motor is used to act as valve opening on the system. the servo motor is to be used to control the position of opening and closing the valve. The servo motor is attached between the upper tank and lower tank which is to control the amount of water flow to from the upper to the lower tank. furthermore, in the servo design, a ball valve is used to be connected with the servo motor. As when the user selected the servo position, the ball valve will move accordingly.

As shown in Table 2, it can be seen different angles of the servo motor which was applied. The servo position was tested and starting from 25 and gets higher with 50 until it reaches the maximum position of the servo to be applied which is 100 percent. However, the servo motor capable to rotate until 180 degree but since the servo motor is attached with ball valve, therefore, the ball valve can only rotate 90 degree. Throughout this test it was noticed that the time and flowrate changed along with the valve position.

Table 2. Testing on the valve angle, time and flowrate

Test No.	Motor Angle (%)	Time (s)	Flowrate cm^3/ sec
1	25	109	9.17
2	50	83	12.04
3	75	67	14.92
4	100	43	23.25

After the testing of the servo motor position was done where the time and the flowrate of the of this process was observed and analysis. Figure 8. Ilustrastes the graph of the vale angle, time required, and the flowrate. The setpoint (desired level) was selected to be 10cm. As such, when the valve angel is opened 25 % the the flowrate is 9.17 cm^3/ sec, as it is the smallest flow can the water to be pass thorugh the valve to fill the lower tank. Also, it was observed that the time required at this stage will take 1.8 minute to fill the lower tank. Since the valve diameter was 8mm, therefore, the servo poistion were limited to have four angles due to the size of the valve. Other observation was noticed is that since both upper tank and lower tank have the same area which is $100cm^2$. Thus, the lesser time reauired to fill the lower tnak when the setpoint is 10cm and the valve position is fully open will take 43 second.

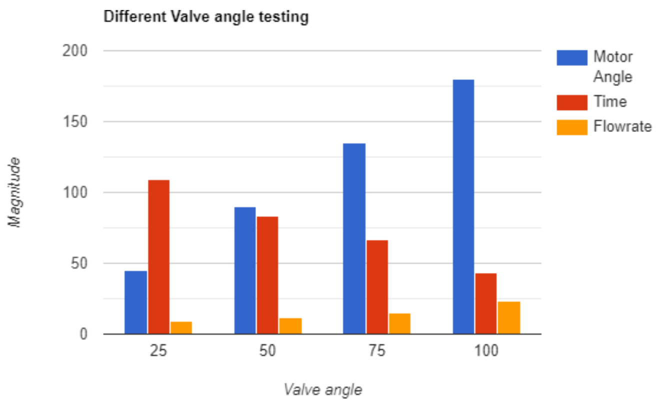

Figure. 8. Testing on the different valve angle

4.3 Pump voltage test

A small water pump is a device which been used to transport water or different kind of liquid. An electric water pump consists of motor that assist to move the liquid from either lower tank to upper tank. However, the pumps not only used to transport liquid, they are used to maintain a constant flowrate or constant pressure. There are plenty of different kinds of pumps use in our daily life such as mechanical pumps and electric pumps. In this project a mini water pump was used to transport water from the lower tank to the upper tank. In addition, different types of pumps were tested in the system, yet only one pump were chosen in this project due to its feature and the capability to sustain different pressure of liquid.

In this test, the performance of the pump used in this project will be tested based on the flowrate and the time required to the fill the upper tank in the system. Table 3, Shows different DC voltage which were tested in the pump to observe its working efficiency. Since the upper tank of the system is the storage and the lower tank is with level sensor which to measure the water level. Therefore, the time and flowrate will be varied according the voltage supply applied to the pump.

Table 3. Different voltage applied

Different voltage	Current	Time (s)	Flowrate cm^3/ sec
5V	1A	112	1.96
6V	2A	75	2.93
9V	2A	58	3.79
12V	3A	41	5.36

In the process of testing the pump in this project. Different voltage supplies were connected with the pump. However, when 5V supplied to the pump it was observed that the time required to fill the upper tank was 112 second and the flowrate was 1.96 cm^3/ sec. Taking in consider the height of the upper tank is 22cm. The flowrate was found by finding the volume of the tank over the time required to fill the tank. Additionally, it was also observed when 12V supplied to the pump the time required to fill the upper tank decreased and the flowrate increased, as shown in Figure 9.

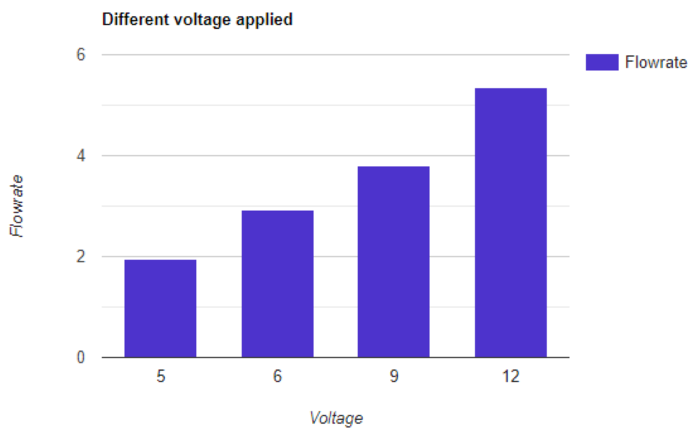

Figure. 9. Different voltage supplied

4.4 PID parameter (kp) tuning test

The process of developing the performance of the system started by included a controller to the system. The PID controller was added to control the water level of the system. followed by the pervious tests made, this test will be focusing on the Kp gain of the P controller. The Proportional controller is to be tuned in this test to observe the system response and analysis its output. Since this project is lab kit it was essential to provide the simulation graphs result when each of the PID controller adjusted or tuned. The PID simulation based on the hardware of the water level was obtained in the earlier chapter. Therefore, the changes of the system response as when the proportional controller included to the system will be illustrated in the following section.

In this test the experimental setup of the system consists of coupled tanks upper tank and lower tank with level sensor to measure the water level in the lower tank controlled by PID which done in LABVIEW software. The LBVIEW is used to monitoring the tank level based on the setpoint given and analyzing the output (water level) by tuning the Proportional controller (P) and observing the changing in rise time, settling time, steady state error. Table 4. Shows the different value applied to the Proportional controller (P) and the results obtained due to the tuning method.

Table 4. Proportional controller tuning test

(P)controller values	Rise time	Settling time
0.008	8.25	9.75
0.012	5.83	8.52
0.022	3.25	5.7

For this system, there was no overshoot. Therefore, there was no need to control the overshoot of the system. However, it was noticed that the rise time and the settling time of the system to reach the final value was high and needed to be controlled. The proportional controller in this test analyzed based on effect that it will produce on the rise time and the settling time. Figure 10. Shows three proportional graphs that have been tuned with three different values. The first tuning value of the proportional controller was 0.008. where the setpoint was chosen to be 10cm. It was observed that when the proportional controller increased the system response get faster and the rise time decrease. On the contrary when the proportional controller decreased the system response get slower and the rise time increased. In addition, the line with green color represent the proportional gain as when its tuning value was 0.022. It was observed that the settling time decreased in which the graph gets stable when it reaches to the setpoint. Therefore, it can be said that the proportional controller is suitable for systems required fast response to perform desired results.

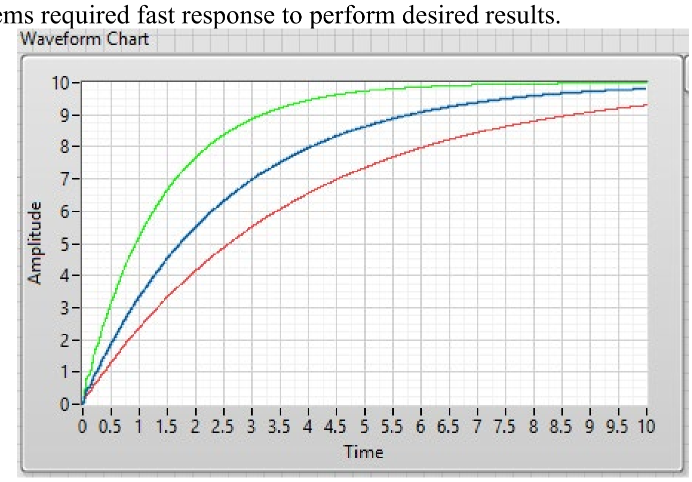

Figure. 10. Proportional controller tuning graphs

4.5 PID parameter (Ki) tuning test

The integral control is a different type of operation used throughout PID controllers. The second method of feedback control is integral control. It is also utilized since it can eliminate all possible deviations. The system, therefore, restores to a constant state and its initial configuration. A negative error reduces the signal to the system, whilst the positive error increases the signal. Nevertheless, only I controllers are much slower than P-only controllers in response time since they rely on some more variables. The combination of I-only control with another type, like P or PD control, will minimize this slowed down response time. I-only monitors are used frequently where calculated factors must be maintained within a very small range and have to be precisely tuned. I monitor the system by referring to a previously acquired error. The concept behind the integral regulation is that deviations are proportionally influenced by their collective size.

As the process of the previous test of the proportional controller was analysis. The same concept is applied in this test, but the tuning process is done for the integral controller. Table 5. Shows three different tuning values which was applied to the integral controller to observe the system response. where the setpoint in this test was selected to be 10.

Table 5. Integral controller tuning test

(PI)controller values	Rise time	Settling time
0.015	1.78	4.91
0.025	3	6.7
0.035	4.25	9.32

The process of tuning the integral controller has some effect on the system in terms of the rise time and the settling time. Figure 11. Illustrate the three lines with different tuning values of the PI. Where it was observed that when the tuning value of the PI is 0.015, it shows fastest in rise time among the other values selected. Also, the settling time in this tuning value decreased compare to the other PI values. Therefore, it can be said that when there is an increase in the PI value the rise time will decrease, and the settling time increases.

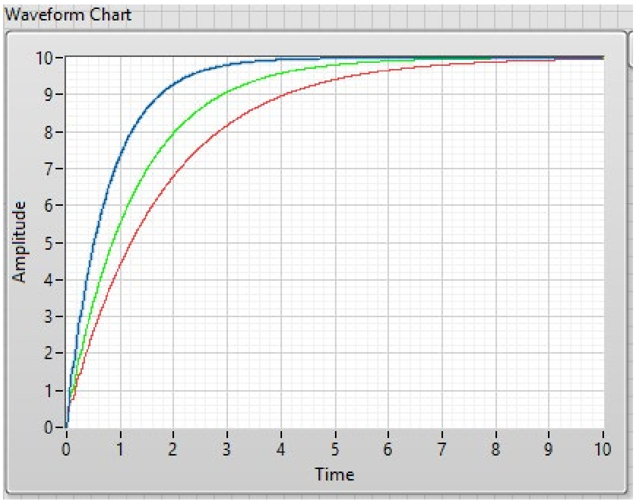

Figure. 11. Integral controller tuning graphs

5. System GUI

This section will include and explain the hardware and simulation results of the whole system. Figure 12. Illustrate the GUI for the coupled tank system which was developed using LabVIEW software. The GUI was built to be understandable for students to practice and gain knowledge in control system. As the main objective of this project is to make the students know the effect of using the PID controller. Therefore, the system was developed in such a way to make the user capable to select multiple choices. These choices are the system operation type, setpoint, and choosing the valve position. The system starts by selecting the operation type. The operation type involved two options either operating the system with PID or without PID. After the operation was selected, the user can set the desired water level. Once the setpoint chosen, the user can select the PID parameters to see the performance of the system with different PID parameters. In addition, the user will have an option to choose between different valve angle.

The gauge block shown in the GUI represent the choosing valve angle. The PID controller was designed to maintain the desired water level by manipulating valve's angle. The PID will send a signal to the valve when the reading of the water level sensor is near the desired level. Thus, the water flow will be reduced before reaching to the desired level to ensure that the water level does not reach above the selected.

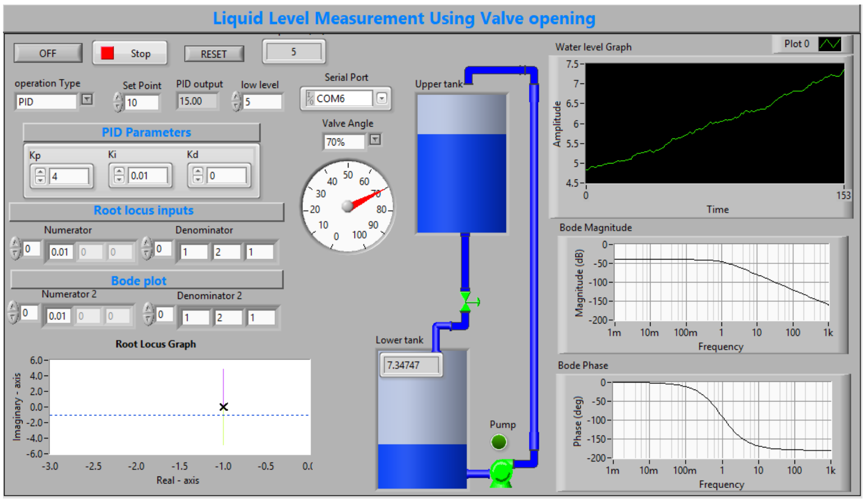

Figure.12. System GUI

6. System response with PID and without PID

From Figure 13. It can be seen the graph of the water level as when the PID was not added to the system. The set point (desired level) was chosen to be 10 cm and the valve position was selected to be 60% opening. However, it can be observed that the system has some errors in the reading of the sensor in which the water level reaches approximately one centimeter higher than the set point given. This was happened due to the delay of the reading of the ultrasonic sensor and the motion of the valve. It was also observed that the water needs more time to reach the desired level. The signal has some distortion due to the noise from the reading of the ultrasonic sensor.

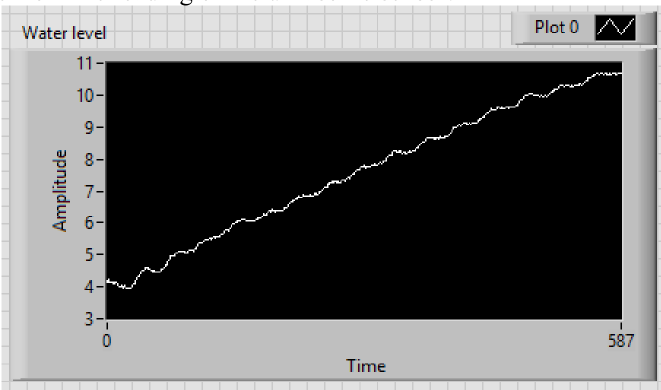

Figure. 13. Water level graph without PID

After the system was implemented, it was observed that the system without PID has some errors where the water level was not matching the setpoint given. Therefore, the PID controller was developed to enhance the system in different ways such as decreasing the overshoot and the settling time. This was achieved by manipulating the PID parameters which are Kp, Ki, and Kd to get the desired water level. Each PID parameter has its own job such as the value of Kp was set to be 4 to decrease the steady state error. The valve of Ki was set to be 0.01 to decrease the overshoot. Lastly, the value of Kd was set to be 0.2 to decrease the rise time as well as settling time. Resulting this the desired level was achieved without any errors shown in Figure 14.

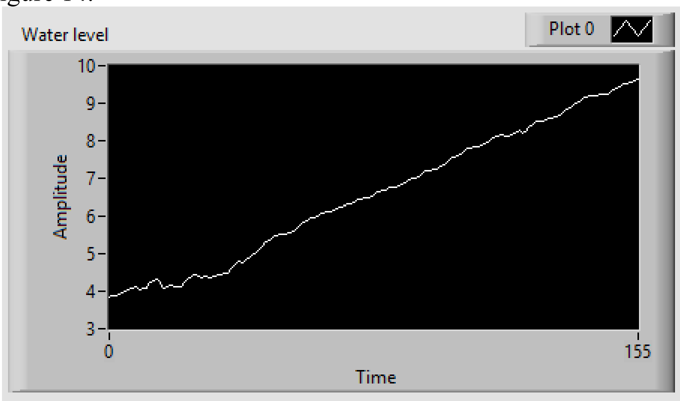

Figure. 14. Water level graph with PID

7. Conclusion

Controlling of liquid level and flow among the tanks is an elementary issue in the process industries. Where tanks are consequently coupled together and therefore, the levels interact and essentially continuously be controlled. Besides, level measuring and flow control are the core of chemical process control systems. PID type controllers have been commonly used in industrial applications. Also, PID controller provides the easiest and most effective solution to numerous real-world control problems. In addition, during the studies of PID controller students facing lack of knowledge in controlling the PID as a hardware where this is due to the complexity of the PID controller to be implemented. Therefore, the proposed project of lab kit liquid level measurement using valve opening will be built to aid the students to have fully understanding of the system. Prior the designing of the proposed project a research has been done on different 10 journals related to the liquid level control system. The research was made in order to gain knowledge and information of the methods and techniques that have been conducted by other researchers in order to implement the system. In addition, it found that according to some researchers, the LABVIEW software is preferable to be used to control the liquid level using PID rather than other software. This is due to the simplicity and flexibility when programming the system. However, it found that some of the researchers have limitations. Where some of the researchers did not develop a GUI of the system also none of the researchers controls the degree of opening and closing the valve. The proposed system is then to be designed after gaining sufficient knowledge where the investigation on components and tools have been chosen to be implemented to the project. As The program will be made in LABVIEW software and the hardware components are valve, level sensor, pump, and relay. Additionally, the propose system is developed with GUI. The user can then input the setpoint “desired level” and the results of the desired level and PID graph will be shown to the user.

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