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EE447 - Term Project - Water Level Controller Preliminary Report

A. Introduction

In this term project we are going to build a multifunctional system that controls water level using TM4C123G microcontroller and its utility modules.

We are expected to detect water level using a water level sensor, and try to keep the water level in a range using two water pumps. A user interface,with a Nokia 5110 LCD, will also be integrated with this system to show the current configuration and measurements.

Figure 1, on the left shows the flowchart of the main program. In this complex system first we need to set a threshold value for water level. This will be done with a POT using ADC module of TM4C123G microcontroller. From the water level 256 samples should be collected and stored in an array. Then, the average value of these samples should be calculated and compared with the threshold value. If the water level is below the threshold value system will activate a water pump to fill the container, else it will use the other pump to drain water from the container. The value of the threshold and water level measurement will be displayed on the user interface simultaneously. Using SysTick interrupt, the system will check the elapsed time since the last LCD update and if the elapsed time is more then 1 second LCD will be updated with the most recent data.
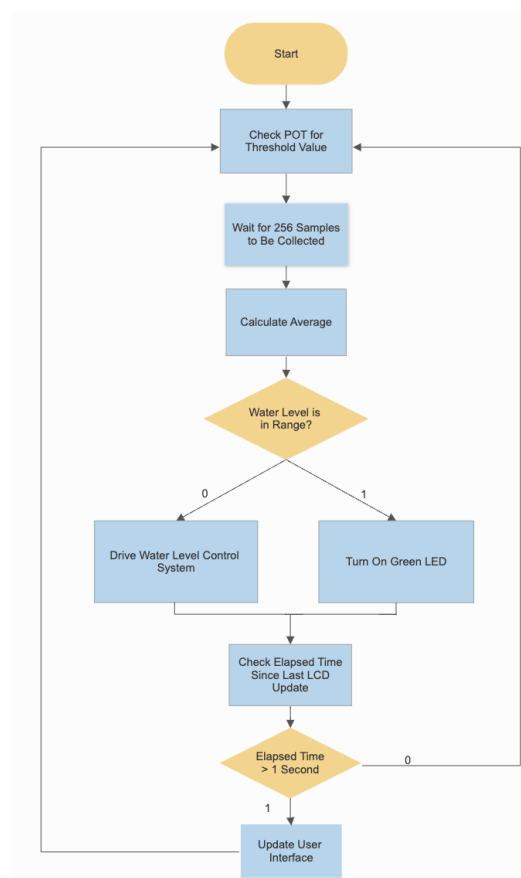

Figure 1. Main Program Flowchart

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More detailed information and requirements about the individual parts of the system will be explained in detail in the following parts of this preliminary report.

B. Water Level Sensing

Water level sensing will be done by using a water level sensor. The sensor will be powered by DC 5V output of the TM4C123G. This sensor behaves just like a pot, which means the water level difference creates a resistance difference in the circuitry so after collecting samples from the data pin of the sensor using one of the ADC modules, we will get a 12 bit conversion in the span of 0 Volt and 5 Volts. Using this data our system will detect the current level of the water and proceed accordingly.

256 samples will be collected in an array at each iteration and averaged to get a more accurate data to compare with the threshold value. ADC reading will be done using SysTick Interrupt Handler.

C. Controlling Water Level

Controlling the water level in the container is going to be handled with 2 water pumps and a water level sensing system working simultaneously. If the averaged data of the water level is below the threshold value the system will run the water pump which is for filling the container. If the water level is above the threshold value another pump will drain water from the container. We are going to drive water pumps using GPTM Interrupt Handler according to the water level.
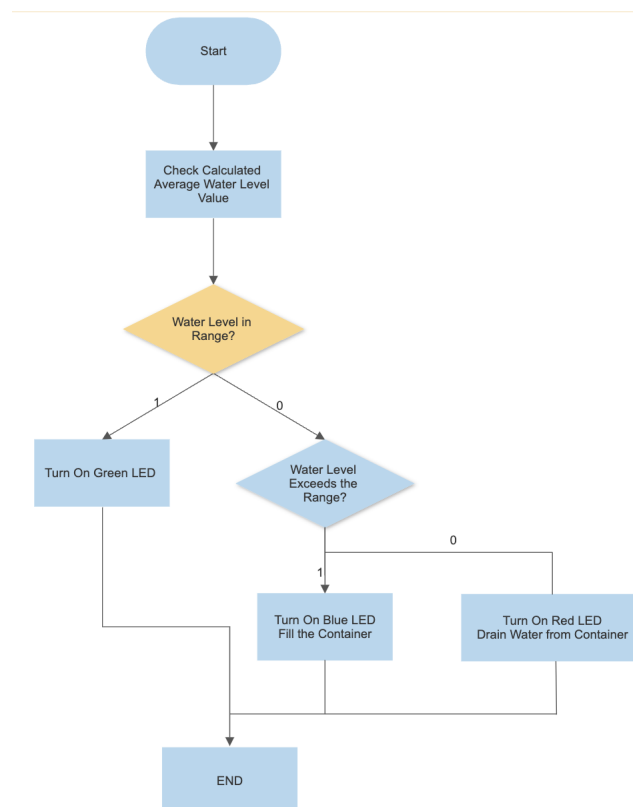

Figure 2. Water Level Control System Flowchart

D. User Interface

The user interface of the system consists of two different output elements which are a Nokia 5110 LCD Screen and onboard LEDs. The first one is the LCD screen. In this element, two main pieces of information will be shown which are the detected water level and the water range. In addition, the LCD screen will be refreshed every one-second. Detected water information is taken from the Water-Level sensor continuously and the water range is taken from the Potentiometer.

The second one is onboard LEDs. All their colors of LEDs represent the relation between detected water level and water level range. If the water level is below the range, the LED will be red. If the water level is above the range, the LED will be blue and If the water level is in the range, the LED will be green. To enlighten proper LEDs, the system will compare water level and range continuously.
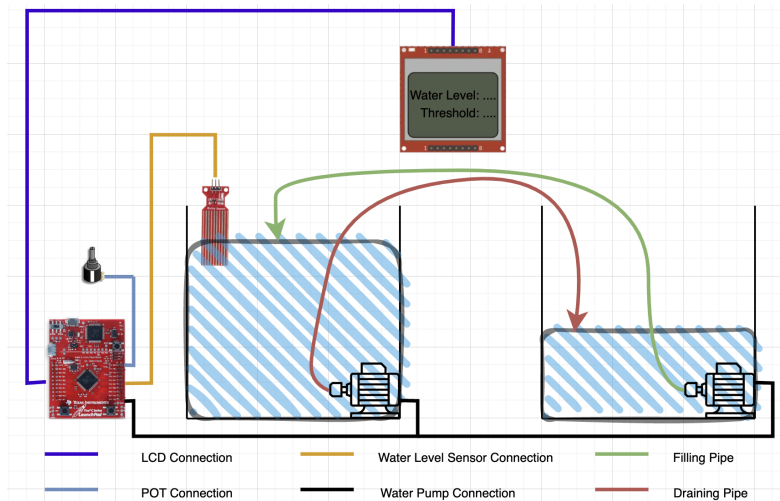

Figure 3. Schematics of the Complete Water Level Control System

From the schematics above in Figure 3, the whole connection and working principle of the system can be observed. Connections made to the TM4C123G are to be changed according to the GPIO ports that are going to be decided later on.

Figure 4: Example Of User Interface

Numbers are not final values.They will be mapped according to threshold values and line information will be added.