IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Volume 3, PP 36-39

Design Of Universal Controller System For Fluid Transfer With Wireless Monitoring

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Abstract: *Fluid management in various industries, buildings, farming, etc is very crucial part yet the technology to manage them lag behind. This paper discusses an optimum solution for the problem of managing various fluids using a single type of controller system. The Universal Controller system is capable of measuring various parameters for different fluids. Sensors are installed in the tanks between which the transfer of Fluid has to be done. The user specifies the condition for switching the pump ON and OFF, by means of software running wirelessly on a computer or on an android application. By analyzing the respective conditions of the different parameters configured by the user, the controller controls the pump. This system makes use of Ultrasonic sensors for level sensing. It has onboard Bluetooth and Wi-Fi for quick and remote interaction with the controller and for the purpose of Data Logging.*

Keywords – *Android, App, Bluetooth, Controller, Fluid, Monitoring, Pump, Python, Real-time, Relay, System, Ultrasonic, Wi-Fi, Wireless*

I. Introduction

Design of universal controller for fluid transfer applications with wireless monitoring is a series of functions to control the fluid transfer applications. The common method of level control for a home appliance is simply to start the feed pump at a low level and allow it to run until a higher water level is reached in the water tank. The operation of the universal controller works using Ultrasonic Sensors and Android-app based Monitoring using Bluetooth. Modifications can be done according to various needs and applications to the controller. The controller can be easily modified to use with various applications involving a fluid transfer. It can monitor various parameters of the fluids to be handled such as quantity, flow, pH, temperature, turbidity, conductivity, etc. It has an advanced mode of working and performs certain operations based on the input it receives. The Universal Controller can be configured easily and is easy to install. It has two different operating modes. The controller also provides Android-based control and monitoring of Tanks with Data Logging. Backup protection is provided to the system in case of any system failure. Consequently, automatic controlling involves designing a universal control system to function with minimal or no human interference. This controller senses the levels of fluid in the tanks over which it is implemented. This information is available to the user on the display screen. Comparing levels & parameters set by the user, the system decides to turn the pump on or off.

Also, with pump control, it ensures that there is no error in the fluid transfer process from one tank to another tank. If any error rises in between or before the transmission process, the system takes appropriate action according to the situation. This indicates the user about the error so that further issues can be solved. It also provides protection to the Pump. It senses Dry Run state of the Pump and even sense the faults that occurred in the pipeline through which fluid is being transferred, and properly switches the pump off. It also alerts the user about the errors occurring in the system by means of a buzzer, app/user interface. It has an Automatic Auto Start function which enables full automation of the controller. The system turns ON the pump, every day at a specific time as per set by the user. This feature of the system makes 'no-human intervention' possible, in the normal operation. It also alerts the user about the overflow of the container to the user or if an error occurs, so that the user can take proper required actions, providing a complete solution for fluid transmission systems and plants.

II. Problem Statement

Fluid management in various industries, buildings, farming, etc is a very crucial part, yet the technology to manage them is very behind. Every specific application needs a unique control system to perform various operations. These controllers need to be highly advanced and must suffice every need for controlling a single operation. The available products and technologies in the market lack the advancement in such management process and miss some basic and necessary needs for necessary tasks. The existing technologies do

not provide a Universal Controller System for Fluid Management which can be used for any type of application involving fluid management tasks and also lack the wireless monitoring.

III. Hardware design

Figure (1) illustrates the flow diagram of the Universal Controller System for Fluid Transfer with Wireless Monitoring.

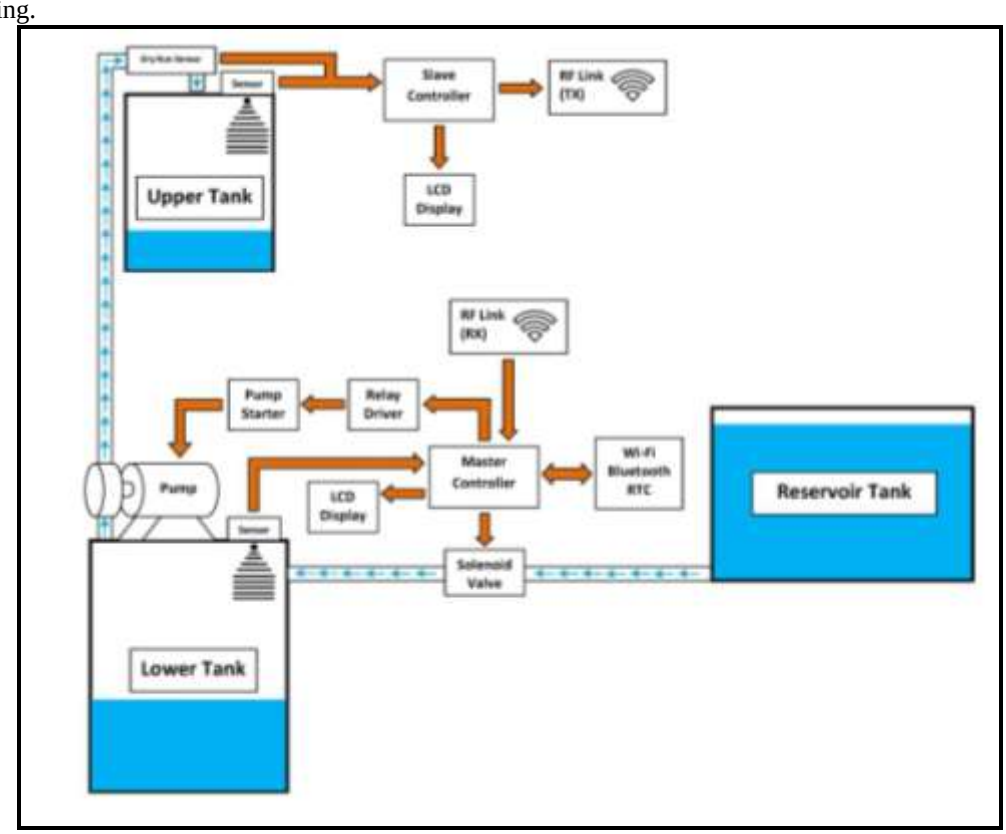

Fig.1 Flow diagram of the system

The Universal Controller System is used for the water transmission process as shown in the diagram above. The system consists of three tanks, viz., the reservoir tank, the lower or basement tank and the upper tank. The Controller System controls the water flow process between the three tanks by analyzing water levels of all the tanks as well as certain other parameters set by the user. It controls the water from the reservoir to the lower tank by means of a solenoid valve in the system. The pump controls the transfer of water from the lower tank to the upper tank. The Master Controller gets the data from the slave controller about the upper tank, by means of wireless RF communication. Various other components such as Wi-Fi module, Bluetooth Module, RTC Module have also been connected to Master Controller for real-time, remote communication and control. Both the Master and the Slave controller consist of LCD displays to provide onboard system status and tank levels to the user.

Following are the major components involved in this project,

A. Ultrasonic Ranging Module

Ultrasonic ranging module HC - SR04 provides 3cm - 450cm non-contact measurement function, the ranging accuracy can reach up to 4mm. The modules include ultrasonic transmitters, receiver and control circuit. The module communicates with the microcontroller using two pins named Trigger and Echo.

The IO trigger of the Ultrasonic sensor is kept high for 10us. The module automatically sends eight signals of 40kHz and detect whether there is a pulse signal back. If the signal returns, through high level, time of high output IO duration is the time from sending ultrasonic to returning.

The Test distance is calculated as, Distance = (high level time x velocity of sound (340M/S)) / 2

B. Wi-Fi Module

ESP8266 is used to host the application or to offload WiFi networking functions from another application processor. When ESP8266 hosts the application, it boots up from an external flash. It has an integrated cache to improve the performance of the system in similar applications. ESP8266 can be applied to any micro-controller design as a Wi-Fi adaptor through SPI / SDIO or I2C / UART interfaces. With the complete and self-contained Wi-Fi networking capabilities, ESP8266 can perform either as a standalone

application or as the slave to a host MCU. The compact design reduces the PCB size and requires less number of external circuitries. Wifi module provides communication access between the master controller and control and monitoring station.

C. RF Link

The 434MHz RF link kit consists of transmitter and receiver, popularly used for remote control. It has a frequency of about 434MHz. It uses Amplitude shift keying modulation. The Transmitter Input Voltage is from 3-12V and it got Receiver Data Output: High- ½ Vcc, Low- 0.7v. RF module is used for long range and unidirectional wireless communication between master and slave.

D. Bluetooth Module

The HC-05 module is designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration for the purpose of wireless communication. This Bluetooth module is fully qualified Bluetooth V2.0+EDR 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. By default the factory setting is SLAVE. The slave modules can only accept connections. They cannot initiate a connection to another Bluetooth device. The master module can initiate a connection to other devices. The user can use it simply as a serial port replacement for establishing connection between MCU and GPS, PC to your embedded project

E. Real Time Clock

A real-time clock is a computer clock that keeps track of the current time. The DS1307 real-time clock IC is an 8 pin device using an I2C interface. It is a low-power clock/calendar with 56 bytes of battery backup SRAM. The RTC provides seconds, minutes, hours, day, date, month and year qualified data. The end date of each month is automatically adjusted, especially for months with less than 31 days, including corrections for leap year. The RTC operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power sense circuit. It not only detects power failures but also automatically switches to the battery supply.

F. Solenoid valve

A solenoid valve is an electromechanically operated valve. The valve is operated by an electric current through a solenoid in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on chamber branching into several openings. Solenoid valves are used frequently as control elements in fluidics. The tasks carried out by the solenoid valve are to shut off, release, dose, distribute or mix fluids.

IV. Software

The Universal Controller System communicates with a software running on PC, implemented using Python. The Controller operations can be controlled and monitored using this software wirelessly proving an efficient system to be used for multipurpose applications. The software enables the user to configure the Controller as per the needs of the application, eradicating the problem of linking to specific controllers for a specific task. The Universal Controller System can also be controlled and monitored by using an Android application.

V. Future Scope

'Two Pumps Controller' instead of a single Pump controller can be implemented in order to provide a backup if anyone of the pump fails or stops working, so as to keep the fluid transmission process always in proper operation. GSM/GPRS can be implemented in the system for full independent remote access and control to the system. The controller can be modified for Industries having requirement of multiple pumps for a process with various independent parameters. Data-logging and data-collection could be implemented for tracking and reference puposes.

VI. Conclusion

Universal Controller Systems are being developed by many companies and are being utilized for process automation in industries. Many Authors have presented issues and challenges in this technology. Research is being carried out on the design of an efficient universal controller system. In this system, it is possible to control one pump process by analyzing various parameters of the system using sensors. In the future, it is possible to improve this system by extending multi-pumps support with unique parameters based independent control. Some of the advantages are, it is fully automatic, i.e it can fill the fluid and transfer it on its own. It prevents the wastage of fluids caused due to the overfilling/improper supervision of the tanks, due to

humans. It is electrically efficient and thus saves Energy. It provides detailed information about the levels of the tanks. The Pump is also protected by the Free-Run/Dry-Run state. It helps in reducing the maintenance cost. It provides full Manual control, level monitoring and Data-logging via an Android- app to the user. - It provides a Backup mode to the user if the sensors fail or there are some problems in the system.

References

[1]. Yogita Patil and Ramandeep Singh, Smart Water Tank Management System for Residential Colonies Using Atmega128A Microcontroller, *International Journal of Scientific & Engineering Research*, Volume 5, Issue 6, June-2014, ISSN 2229-5518
[2]. Sanam Pudasaini, Anuj Pathak, Sukirti Dhakal and Milan Paudel, Automatic Water Level Controller with Short Messaging Service (SMS) Notification, *International Journal of Scientific and Research Publications*, Volume 4, Issue 9, September 2014, ISSN: 2250 - 3153
[3]. Pranita Vijaykumar Kulkarni and M. S. Joshi, An IOT based Water Supply Monitoring and Controlling System with Theft Identification, *International Journal of Innovative Research in Science, Engineering and Technology*, Vol. 5, Issue 9, September 2016, ISSN: 2319 - 8753
[4]. V.Sanjana Devi, G.Gayathiri and S.Manjuparkavi, Smart Water Supply Management, *International Conference on Explorations and Innovations in Engineering & Technology*, 2016, ISSN: 2348 – 8379
[5]. http://www.micropik.com/PDF/HCSR04.pdf
[6]. https://www.espressif.com/sites/default/files/documentation/0a-esp8266ex_datasheet_en.pdf
[7]. https://wiki.eprolabs.com/index.php?title=Bluetooth_Module_HC-05
[8]. https://www.sparkfun.com/datasheets/Components/DS1307.pdf