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Submersible Pump Water Flow Controller

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ABSTRACT: A submersible pump is a centrifugal pump. When is attached to an electric motor and paired with an Arduino microcontroller, these pumps can automate the flow distribution process which can be useful in application such as aquariums, fountains and other systems for irrigations, refilling and aeration.

Keywords: Arduino Uno, Nano microcontroller, Motor Driver Module L298N, Jumper Wires, Propellers.

I.INTRODUCTION

This is a semi-autonomous, aduino microcontroller based electronic pump controller, Arduino programs contains instruction which facilitate the mediation process. An appropriate program in the arduino microprocessor to interact with the android controller is developed. The program has been successfully complied through arduino IDE to the arduino microcontroller; loaded into it after proper checking of logic to decrease any loss/damage of hardware. The interface is easy to use and provide feedback from the arduino microprocessor giving instruction to arduino for various actions through interface.

A submersible pump is a type of pump designed to be fully submerged in water or other liquids. It is sealed hermetically and placed within the fluid it needs to pump. These pumps are commonly used for various applications, including residential water wells, sewage pumping, industrial pumping, and fountain systems.

Figure 1: Arduino based Submersible pump water control

1.1 Features of the Electronic Submersible Pump:

Electronic Submersible Pump has many advantages over a fuel driven pump. Some of thesalient features are as follows:

Efficiency: The controller ensures efficient water usage by automatically activating and deactivating the pump based on the water level. This prevents unnecessary water wastage and optimizes the pump's operation.

Convenience: The automated system eliminates the need for manual monitoring and control of the water pump. Users can rely on the Arduino controller to handle the pump operation, saving time and effort.

Water conservation: By controlling the pump based on water level, the system promotes water conservation. It prevents overfilling or emptying of water tanks, thus reducing water consumption and preserving this precious resource.

Protection against dry running: The controller includes safeguards against dry running, which occurs when the pump operates without sufficient water supply. Dry running can damage the pump and reduce its lifespan. The automatic system prevents this by shutting off the pump when the water level is too low.

Flexibility and customization: Arduino-based controllers are highly customizable and can be programmed to suit specific requirements. Users can adjust parameters such as water level thresholds, pump activation/deactivation timings, and even incorporate additional features like alarms or remote monitoring.

Cost-effectiveness: The automation provided by the Arduino controller helps optimize water usage, reducing overall costs associated with water consumption. It also safeguards the pump against damage, potentially extending its lifespan

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and reducing maintenance or replacement expenses.

Energy efficiency: With the automatic control of the pump, energy consumption is optimized. The pump operates only when necessary, leading to energy savings and lower electricity bills. Reliability: Arduino controllers are known for their reliability and stability. They can accurately monitor water levels and control the pump operation, providing a dependable solution for water management.

Overall, an Automatic Water Pump Controller using Arduino offers efficiency, convenience, water conservation, protection against dry running, customization options, cost-effectiveness, energy efficiency, and reliability, making it a beneficial solution for managing water pumps in various applications.

II. RELATED WORK

This submersible pump contains an Arduino microcontroller with basic mobility features [1]. This work aims to make an Arduino based boat which can highly contribute to disasters. These technologies help people in various ways, for example, rescue operations, essentials delivery, roads having large distance than water and others [2]. The Arduino is an open source device that has been the brain for numerous research. The Arduino has everything that is required by the user which includes its inbuilt converter, I/O pins etc. With the combination of Arduino one can control a range of things, like home Lightings, air conditioner and others through smartphones [3].We have used Arduino because it is an open source device which can be programmed through standard operating systems like Windows, Mac, Linux, etc [4]. In this work we developed an automated pump prototype built with Arduino and controlled with software working on Android that can regulate fluid flows. Until now research and analyzing the simulation of experiments shown, it is believed that it is feasible to use the prototype designed to cognitive development, for future users can learn to insert custom paths that can process logic issues and more complex mathematics allowing the prototype perform the desired flows. Analyzing the financial costs of design, it is believed that it is feasible to construct this type of prototype because it presents a low cost of the components used, particularly if they choose in a large scale production. It is worth noting that both the Java programming language as the language for Arduino in development are free, not burdening additional costs for the development of the project, pointing out that this applies also the tools used for development[5,6].

III. DESIGN OF OUR SUBMERSIBLE PUMP WATER FLOW CONTROLLER

An submersible pump water flow is designed by using Arduino Nano, 12V submersible pump, LN298N Motor Driver. This pump can be rotated both in clockwise and anti-clockwise directions. Pump's operational speed and consequently the fluid flow rate is accurately controlled. The Arduino Nano and the LN298N Motor are the heart of this electronic submersible pump controller [7,8]. The block diagram of this submersible pump circuit is illustrated in Figure 2. Motor controllers (or H-Bridge drivers) are used for direction and speed control of the pump.. With a motor controller, it can be chosen to operate the pump motor to go clockwise, or anti-clockwise while also controlling the speed with PWM signals.

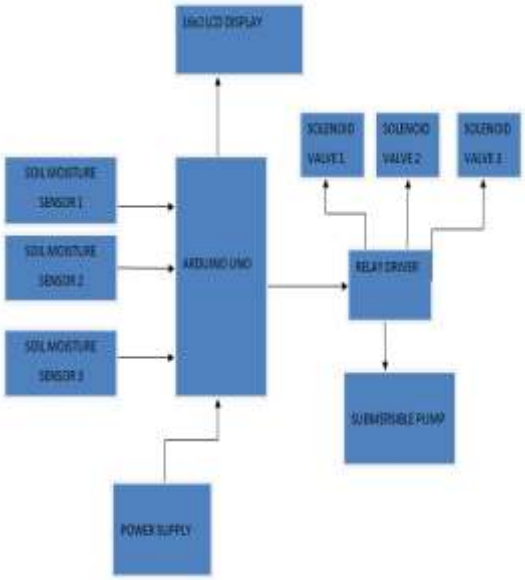

Figure 2. Basic Block Diagram of submersible pump

3.1 Arduino Nano

The Arduino Nano is an open-source microcontroller board based on the Microchip ATmega328P. The board is equipped with sets of digital and Analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 Analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.. The ATmega328 on the board comes pre-programmed with a bootloader that allows uploading new code

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to it without the use of an external hardware programmer. We have used Arduino nano in this project, which is a smaller version of Arduino uno.

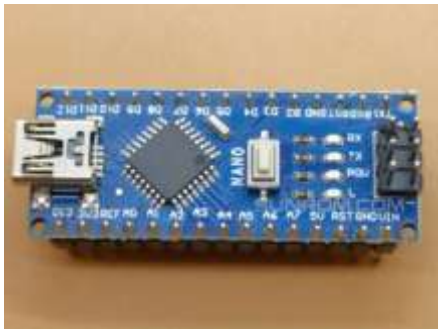


Figure 3. Arduino nano module

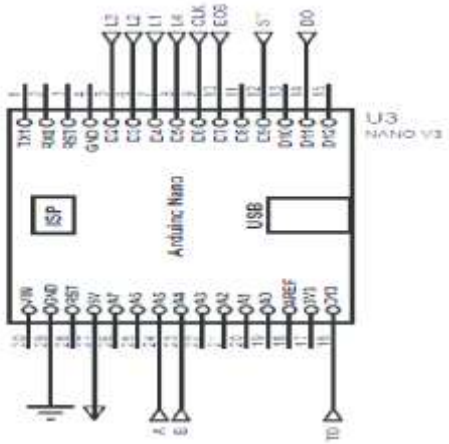


Figure 4. Pin diagram of arduino nano.

3.3 Motor Driver Module L298N

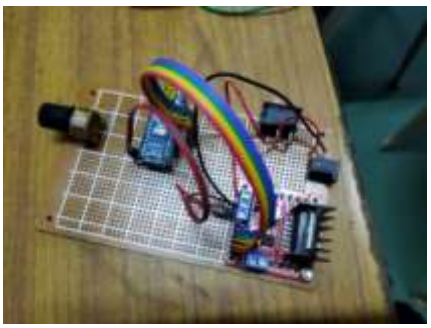
This L298N Based Motor Driver Module is a high power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L298 motor driver IC and has the onboard 5V regulator which can supply an external circuit. It can control up to 4 DC motors, or 2 DC motors with directional and speed control.

An H-Bridge is a circuit that can drive a current in either polarity and be controlled by Pulse Width Modulation (PWM). Pulse Width Modulation is a means of controlling the duration of an electronic pulse Motors are rated at certain voltages and can be damaged if the voltage is applied too heavily or if it is dropped too quickly to slow the motor down.

Figure 5. PWM controller module

IV. OPERATION OF THE HARDWARE PART OF SUBMERSIBLE PUMP WATER FLOW CONTROLLER CIRCUIT

The mini pump used in this work is a low voltage, low power pump. However, like most motors, pumps draw larger currents than the 40mA the Arduino output pins can supply. An external power supply is therefore required to power the pump. A transistor, or digital switch, is used to control the pump from the low-current signals of the Arduino's digital pins. An additional concern when powering a pump or motor is back-voltage (also known as counter-electromotive force). When a motor stops receiving current it can continue spinning, generating a voltage in the opposite direction. This reverse voltage can damage circuit components like the transistor. A diode that only allows current in one direction will be added in parallel with the motor to protect the circuit.



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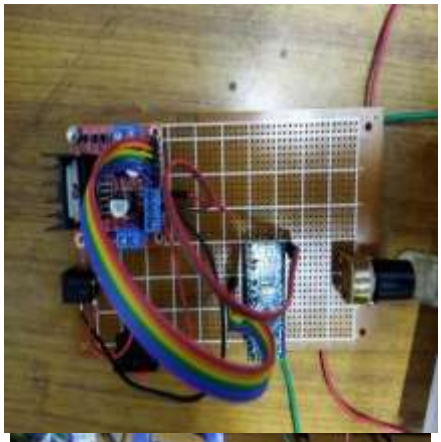

Figure 6: The water speed control of submersible water pump by aurdino

When both the consecutive pulse trains have equal duty cycles, the flow pressure is uniform. When one of the pulse trains has lower duty cycles than the preceding one, the flow pressure is lower. The converse is also true.

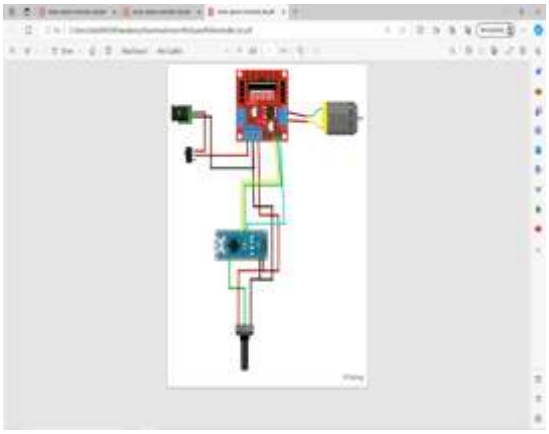

Figure 7: Circuit diagram of the submersible pump water flow controller.

The circuit diagram for the work is drawn in figure 5. Pin connections between the arduino nano board .

V. RESULTS :

We have observed the boolean conditions for the flow of water control .In this device we have used Arduino nano, motor driver. With the help of submersible pump we added its two legs with pipe and with the help of motor driver and Arduino the water is fetched from one mug and the water is out from other pipe and thus the other mug is filled with water. We control this process with the help of potentiometer. We control the speed of the flow of water by the potentiometer. With the help of Arduino the fetching of water is atomatically stoped or automatically started when the water level is maximum and minimum It is very easy to make this device with help of Arduino.using a flow meter the arduino should recognize the flow and decide whether to speed the pumps RPMs of slow it down. The pump's input is connected to the voltage control. So the speed is now controlled by a voltage output from an external source. The more voltage the more RPMs. Other submersible pump it is very difficult to handle to control the flow of water but in this device we can control the flow of water very easily.

Program flowchart of submersible pump water control:

The program flowchart for the water control is illustrated in figure 7. It clearly demonstrates how the fluid flow rate can be stably regulated depending on the PWM controller. The rate can also be controlled for higher or lower pressure, which is realized electronically for the first time in irrigation applications to our best knowledge.

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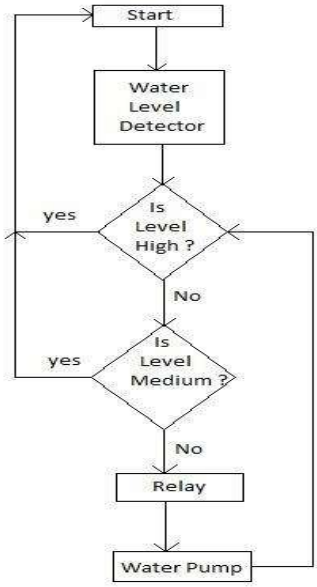

Figure 8: Program flowchart for the flow control of water.

VI. CONCLUSION :

A novel micro-controller based fluid flow control system is designed and developed. It allows smooth and regulated fluid flows. The flow rate and pressure are independently controlled which are achieved for the first time in submersible pumps, to our best knowledge. Work is underway for its future application in irrigation control.

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