Abstract

In metro cities we are not getting 24 hours water supply in residential areas due to in sufficient availability of water. Due to this reason people get water supply only for a limited period of time with limited amount. Therefore, people are not getting quantity of water as per their requirement and at their desired time. Looking to this problem we have planned to make a solenoid valve which will solve both the above mentioned problems.

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1. Introduction

1. Introduction

We are planning to make an automatic valve that will sense and control the supply of water to houses in residential buildings. In every society multiple houses are there and all the houses receive water from a single overhead storage tank and for a limited time. Due to different heights of different houses, the water pressure regulates from lower altitude to higher altitude and due to this most houses receives water at different pressures. To regulate equal of water at same pressure to each house we have made an automatic solenoid valve which will supply equal amount of water in each house in a single day and it will also eliminate the problem of fix timing of water supply. This solenoid valve is attached with a well-programmed Arduino UNO board, which will control the flow rate and the timing of the water supply.

Problem Faced in Current Scenario

In metro cities we are not getting 24 hours water supply in residential areas. Water is being supplied to home at specific time only in a day. This causes many problems such as:

➢ People don't get water as per their desired time,

➢ Unusual supply of water at different floors,

➢ Some people get less amount of water if they get late in turning ON water valve,

➢ All these results in much chaos in residential buildings.

➢ Due to unusual quantity of water supply to houses in buildings, people ruined their relationship with the building members, secretary and chairman, etc.

Solution and Planning

To solve above problems we have planned to make an automatic sensor driven water supply valve that will control the supply of water in each home in a building .Its working will be:

➢ It will supply equal amount of water in all houses,

➢ It will have a time limit of 24hours after which it will get reset,

➢ Due to this every house in a building will get equal amount of water in a day and they don't have to worry about the time limit,

➢ Due to equal quantity of water being supplied to each home, the problem of less water being supplied will be solved.

➢ Once the flow limit gets completed the valve will turn off, and it will get reset only after 24hours.

2. Literature Review

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Plumbing system in buildings consists of underground tank which is supplied water via municipal or water department supply lines, from there with the help of pumps and piping distribution system water is supplied to overhead tank and thereby due to gravity water reaches to home outlets. The overhead tank can however be eliminated if water is supplied directly from underground tank to kitchen toilet outlets, there comes the need of pumps which can give uninterrupted supply of water with required pressure to outlets so that when one opens the tap he gets continuous supply of water. Such pumps are called hydro- pneumatic system. Such pumps consists of small steel tank with water on one side andair on another separated by a rubber membrane .As the pump starts it supplies waterto the wet side thus causing rubber membrane to expand and air compresses on otherside thus causing extra pressure on wet side which is connected to water supply line.So as one opens the tap gets the required quantity of water. This causes the pressureto drop and the pump is automatically switched on again thereby maintaining thepressure of water and at same time supplying the water to outlets.[1]

The advantage of such plumbing system in buildings is that requirement of overhead tanks is eliminated. Secondly these pumps are designed to get the required equal pressure to all floors, unlike in traditional way water flows from underground tanks to overhead tanks and the upper floors gets water with less pressure and lower& ground floor gets high pressure due to gravity and more height. This gives energy conservation also because it eliminates the need of supply of water ten or twenty floors to overhead tank and then supply by gravity to all floors. Continuous power supply backed up with generator is required to operate this system efficiently, else if no power no supply of water.[1]

For plumbing purposes, the term "multi-storey" is applied to buildings that are too tall to be supplied throughout by the normal pressure in the public water mains. These buildings have particular needs in the design of their sanitary drainage and venting systems. Water main supply pressures of 8–12 metres (25– 40 feet) can supply a typical two-storey building, but higher buildings may need pressure booster systems. In hilly areas, the drinking-water supply pressures will vary depending on the ground elevation. In these cases, the water authority may have to specify areas where particular supply pressures can be relied upon for the design and operation of buildings. Where a building of three or more storeys is proposed a certificate should be obtained from the drinking-water supply authority guaranteeing that the present and future public drinking-water supply pressure will be adequate to serve the building. If the public water pressure is inadequate, suitable means shall be provided within the building to boost the water pressure.[2]

A Solenoid valve Operating Life test system based on PLC was developed in order to examine the reliability and durability of a certain type solenoid valve,. In this paper, not only structure and principle of the test system, but also hardware and software design of the test system were illustrated in detail. The really applied results show that the test system can control test parameters quickly and accurately with features of high degree of automation, good reliability and easy to operate. And the test system provides a high-effect testing and researching platform for the development of high-performance Solenoid valves.[3]

Flow meters have proven excellent devices for measuring flow in the irrigation fields as it is required for measuring the water needed in irrigation fields in order to avoid damage of crops with excess water and even to save the water as it is most precious resource. Flow meter also serves the purpose of judging the irrigation pipelines as for example lower than normal flow rates may indicate the need for pump repair or leakage of pipelines. Flow can be measured with contact type or non-contact type of sensor. Accurate flow measurement is an essential step both in the terms of qualitative and economic points of view. Previously a technique known as ultrasonic flow measurement a noninvasive type of measurement is widely used tocalculateflow,becauseofitscapabilitytoavoidnoiseInternationalJournalofComputer Science, Engineering and Applications (IJCSEA) Vol.3, No.3, June 201350 interferences in its output. Now a day due to its nonlinear characteristics its use is restricted. Various types of flow meters are available in the market.[4]

Arduino is an open source microcontroller which can be easily programmed, erased and reprogrammed at any instant of time. Introduced in 2005 the Arduino platform was designed to provide an inexpensive and easy way for hobbyists, students and professionals to create devices that interact with their environment using sensors and actuators. Based on simple microcontroller boards, it is an open source computing platform that is used for constructing and programming electronic devices. It is also capable of acting as a mini computer just like other microcontrollers by taking in puts and controlling the outputs for a variety of electronics devices.[5]

The working principle and applications of an Arduino board.

This also explores on how it can be used as a tool for study and research works.ArduinoboardcanprovideaquicktoolindevelopmentofVLSItestbenchespecially of sensors. Main advantages are fast processing and easy interface. Today, with increasing number of people using open source software and hardware devices day after day, technology is forming a new dimension by making complicated things look easier and interesting. These open sources provide free or virtually low costs, highly reliable and affordable technology. This paper provides a glimpse of type of Arduino boards, working principles, software implementation and their applications.[5]

3. Scope of the Project

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1) Design of valve and following drawings:

- o Valve design
- o Circuit diagram
- o Pipeline system diagram
- o Block Diagram

2) Manufacturing and Assembly of:

- o 12V 2A DC Power Supply Adapter
- o YF-S201Water Flow Rate Sensor
- o 4x4 Matrix Keypad Membrane
- o 1Channel 5V Relay Module
- o Single Strand Wires.(1meter,4colours)
- o 12V 5A Male and Female DC Connectors used for CCTV Security Camera And Lighting Power Adapter
- o 12V DC ½ Electric Solenoid Water Air Valve Switch (Normally Closed)
- o Male + Female 2.1x5.5mm for DC Power Jack Adapter Connector Plug for CCTV Camera
- o 1 Arduino UNO R3
- o 16x2 Alphanumeric LCD Screen (Green)
- o IIC/12C Serial Interface Adapter Module.

4. Methodology

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Following are the steps that we have adopted in the process of developing this automatic valve for controlling water supply in residential areas:

i. Survey to study ground reality: We have visited different societies of different areas and discussed the problems related to water supply with several members of the society and also with the municipal corporation members to ask about the water supply system in the area. After this survey we came to know that in almost all societies water supply is only for a limited period of time in a day. Due to this the society members are facing two major following problems:

   -People are not getting water as per their desired time.

   -Due to different heights of different houses, the water pressure regulates from loweraltitudetohighaltitudeandduetothismosthousesreceiveswateratdifferentpressures.

ii. Meeting Experts: After finalizing the problems we have met with field experts and discussed with them the above given problems and discussed that what should be the possible solution to solve major problems.

iii. After meeting the experts, at the end we came to a solution to these two major problems. The solution is an automatic solenoid valve which will supply equal amount of water in each house in a single day and it will also eliminate the problem of fix timing of water supply.

iv. After this we group members studied about the different water supply pipe line systems of buildings of different societies and also studied about the construction and working principle of a solenoid valve in detail.

v. After studying the pipeline systems, construction and working principle of solenoid valve we made a working simulation with the help of programming app of the whole circuit of the system which will control the water supply.

vi. After developing a well-programmed working simulation of the system we have again researched in detail about the components required in the system and after the research got over we have finalized the components required in the system of automatic valve.

vii   After finalizing the required components for making the automatic valve for Controlling the water supply we have done the programming in the Arduino UNO board and assembled the components and made the whole system ready.

Hardware and Software Requirements:

Hardware Requirements:
- o 12V 2A DC Power Supply Adapter
- o YF-S201Water Flow Rate Sensor
- o 4x4 Matrix Keypad Membrane
- o 1Channel 5V Relay Module
- o Single Strand Wires.(1meter,4colours)
- o 12V5A Male and Female DC Connectors used for CCTV Security Camera And Lighting Power Adapter
- o 12V DC ½ Electric Solenoid Water Air Valve Switch (Normally Closed)
- o Male + Female 2.1x5.5mm for DC Power Jack Adapter Connector Plug for CCTV Camera
- o 1 Arduino UNO R3
- o 16x2 Alphanumeric LCD Screen (Green)
- o IIC/12C Serial Interface Adapter Module.

Software Requirements:

- o Proteus 8
- o Arduino IDE

5. Designing

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Components Required:

1) 12V 5A DC Power Supply Adapter

Fig No: 01

2) Single Strand Wires

Fig No: 02

3) 12V 5A Male and Female DC Connectors

Fig No: 03

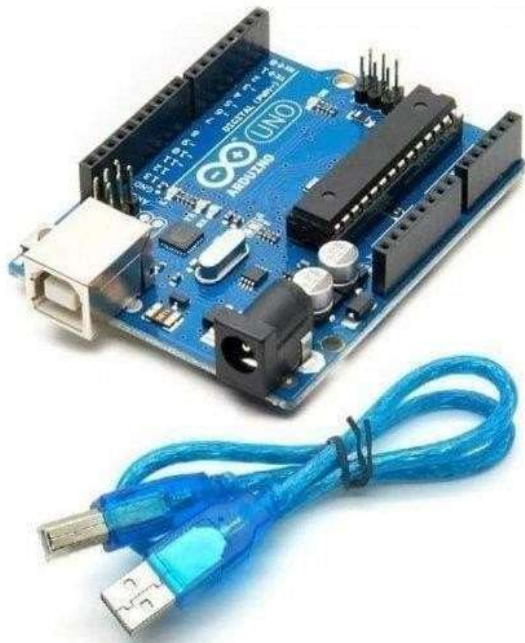4) Arduino UNO R3

Fig No: 04

5) YF-S201 Water Flow Rate Sensor

Fig No: 05

6) 12V DC ½ Electric Solenoid Water Air Valve Switch (Normally Closed)

Fig No: 06

7) 4x4Matrix Keypad Membrane

Fig No: 07

8) 16x2 Alphanumeric LCD Screen (Green)

Fig No: 08

9) 1Channel 5V Relay Module

Fig No: 09

10) IIC/12C Serial Interface Adapter Module.
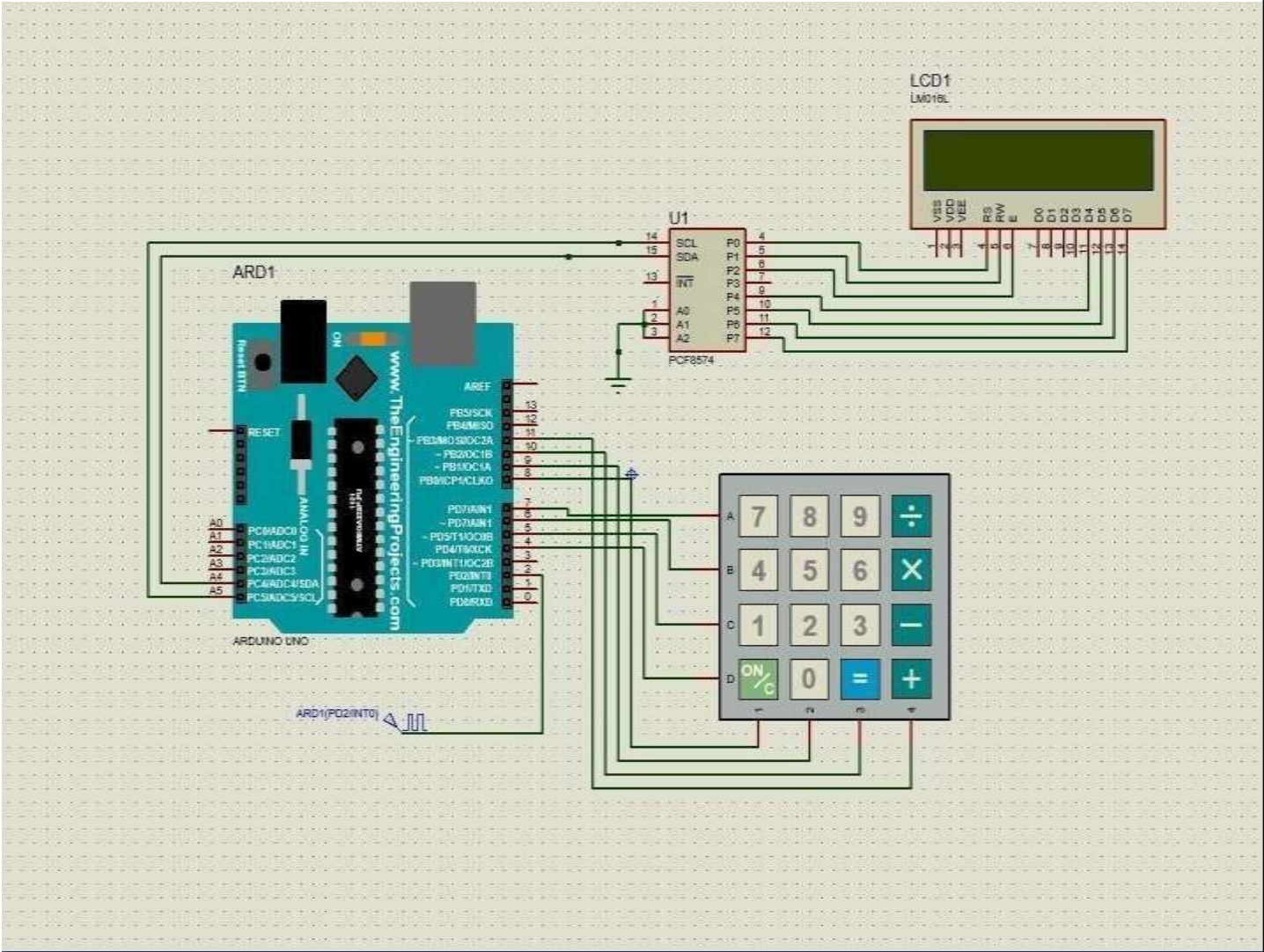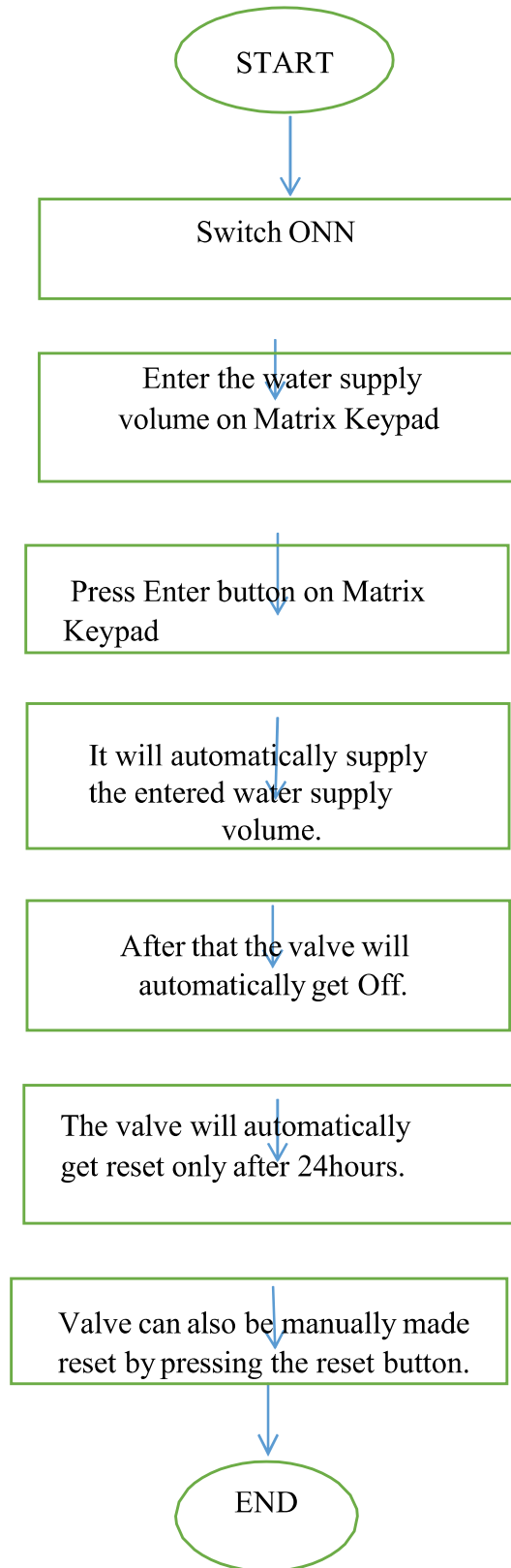

Fig No: 10

Circuit Diagram:

Fig No: 11

System Flow Chart

```
        ┌─────────────┐
        │    START    │
        └──────┬──────┘
               │
               ▼
    ┌─────────────────────┐
    │      Switch ONN     │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │  Enter the water    │
    │  supply volume on   │
    │  Matrix Keypad      │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │ Press Enter button  │
    │ on Matrix Keypad    │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │ It will             │
    │ automatically supply│
    │ the entered water   │
    │ supply volume.      │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │ After that the valve│
    │ will automatically  │
    │ get Off.            │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │ The valve will      │
    │ automatically get   │
    │ reset only after    │
    │ 24hours.            │
    └──────────┬──────────┘
               │
               ▼
    ┌─────────────────────┐
    │ Valve can also be   │
    │ manually made reset │
    │ by pressing the     │
    │ reset button.       │
    └──────────┬──────────┘
               │
               ▼
        ┌─────────────┐
        │     END     │
        └─────────────┘
```

System Flow chart for operating the Automatic Valve.

6. Applications

6. Applications

Our project has many different applications as stated below:

i. Residential Buildings: We can use this system in residential buildings in order to supply equal amount of water to each house with desired timing of members in the society.

ii. Industrial Applications: This system can also be used in industries to control the flow of fuels, liquid chemicals and oils in hydraulic industries. We can also use this system in Foods & Beverages industries.

iii. Water Supply Pipelines: There is also a major use of this system in water supply pipelines such as sub-mains and lateral pipelines of an area.

iv. This product can also be used in every system where there is a requirement of liquid flow.

7. Conclusion and Future Scope

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Conclusion

As stated in the solution and planning sections above, we had setup a demo system by means of mini water bottles and tested the valve and the tendency of it to control the water supply.

After completion of the test, the result obtained seems to be positive and the function of the valve seems to be accurate in controlling the water supply with desired timings.

This valve can be used in residential buildings, industries, major water distribution pipelines of cities and areas etc. where it will solve the problem of water supply and its desired timing.

Future Scope

This application has a large scope as it has the feature which will help in distribution of equal amount of water supply with desired timings, Understand and modify it:

- It will supply equal amount of water in all the further sub-divided pipelines.

- Due to this every pipe line will get equal amount of water in a day,

- Due to equal quantity of water being supplied to each pipeline, the problem of less water being supplied will be solved.

- Once the flow limit gets completed the valve will turn off, and it will get reset only after 24hours.

8. Estimation and Costing

8. Costing Table:

Sr.No.	Component/Part	Quantity	Unit Price (Rs)
1	Arduino UNO R3	1	650
2	1/2 Electric Solenoid Valve	1	300
3	YF-S201 Water Flow Rate Sensor	1	200
4	4x4 Matrix Keypad Membrane	1	120
5	12V 2A DC Power Supply Adapter	1	350
6	Male & Female DC Connectors	1	30
7	1 Channel 5V Relay Module	1	50
8	16x2 Alphanumeric LCD Screen (Green)	1	150
9	Single Strand Wires (1 meter,4 colors)	4	20
10	IIC/12C Serial Interface Adapter	1	100
11	Lighting Power Adapter	1	250
12	**TOTAL**	**14**	**2220Rs**

9. References

9. References:

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