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IEDC PROJECT REPORT

ON

"Digital Water Usage Display"

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PROJECT MENTOR:

Mr. Vikas Bhujade Sir

TO

DEPARTMENT OF SCIENCE & TECHNOLOGY (DST)

CHAMELI DEVI GROUP OF INSTITUTIONS INDORE (M.P)

2019-20

CERTIFICATE

This is to certify that IEDC project report "**Digital Water Usage Display"** is submitted to Department of Science & Technology (DST), by Husain Dhariwala, Mayank Kesarwani, Prakhar Chaurasiya**.** The matter embodied is the actual work done by the **Project Team Members.**

Forwarded By

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DECLARATION

We "Mr. Vikas Bhujade, Husain Dhariwala, Mayank Kesarwani, Prakhar Chaurasiya", hereby declare that the work presented in this project report entitled **"Digital Water Usage Display"** is the outcome of our own work and correct to the best of our knowledge and this work has been carried out as per the guidelines laid down by IEDC Technical Committee.

Project Mentor:

Mr. Vikas Bhujade

Students:

Husain Dhariwala
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1. Project Title:

Digital Water Usage Display

Team Detail:

Project Mentor:

Mr. Vikas Bhujade

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Fig 1. Project Snapshots

About Product:

We have made a device that displays the amount of water used and additionally cuts off the water supply when the specified limit is reached. This project, digital water usage display is capable of saving valuable resource blue gold that is water.

2. Introduction:

Digital water usage display is an automatic water usage monitor and controller which monitors the water usage of a specific water supply line and automatically cuts-off the water supply when a specific limit is reached. The system constitutes of a water flow sensor, a micro-controller, a solenoid valve for cut-off of the water supply and a box that holds the major circuitry.

The system basically operates on Direct Current with low power consumption. The system is consistent on monitoring the volume of water displaced through the pipe with very little error. The USP of the system is that it is automatic with very low maintenance and it provides a way to save water by regulating the water usage in places where multiple users are using the same supply line, so that everyone pays for what they are using.

3. Need for This Project:

- The idea of digital water usage display generated because of the blind wastage of water by people who take this invaluable resource for granted.
- It is assumed that if people actually see their water usage and wastage over a period of time, they will be aware of their activity and will be motivated to save water in the future.
- In places like apartments and townships, they need a smart way to monitor the water usage of multiple households to ensure that nobody is using water in an excessive manner.
- Since there is no specified limit on water usage, everybody uses water without thinking about it and even if there was a limit, there is nothing that can enforce it.

4. Detailed features of the product:

Digital water usage display operates on DC power supply through 3.7V battery. It consists of a water flow sensor, a solenoid valve and a 16 x 2 LCD display. The battery is charged using a buck converter to provide the 4.2V charging voltage. The battery is also connected to a boost converter to provide the required 5V power supply to the water flow sensor and the microcontroller. For the cut-off feature, the solenoid valve is operated by a 12V 2A SMPS.

It uses Atmega 328p for automatic control of the system. It also uses a charging circuit to charge the battery using simple USB. There is also a momentary switch that toggles the monthly usage and the daily usage on the display.

5. Block Diagram and Circuit Diagram:

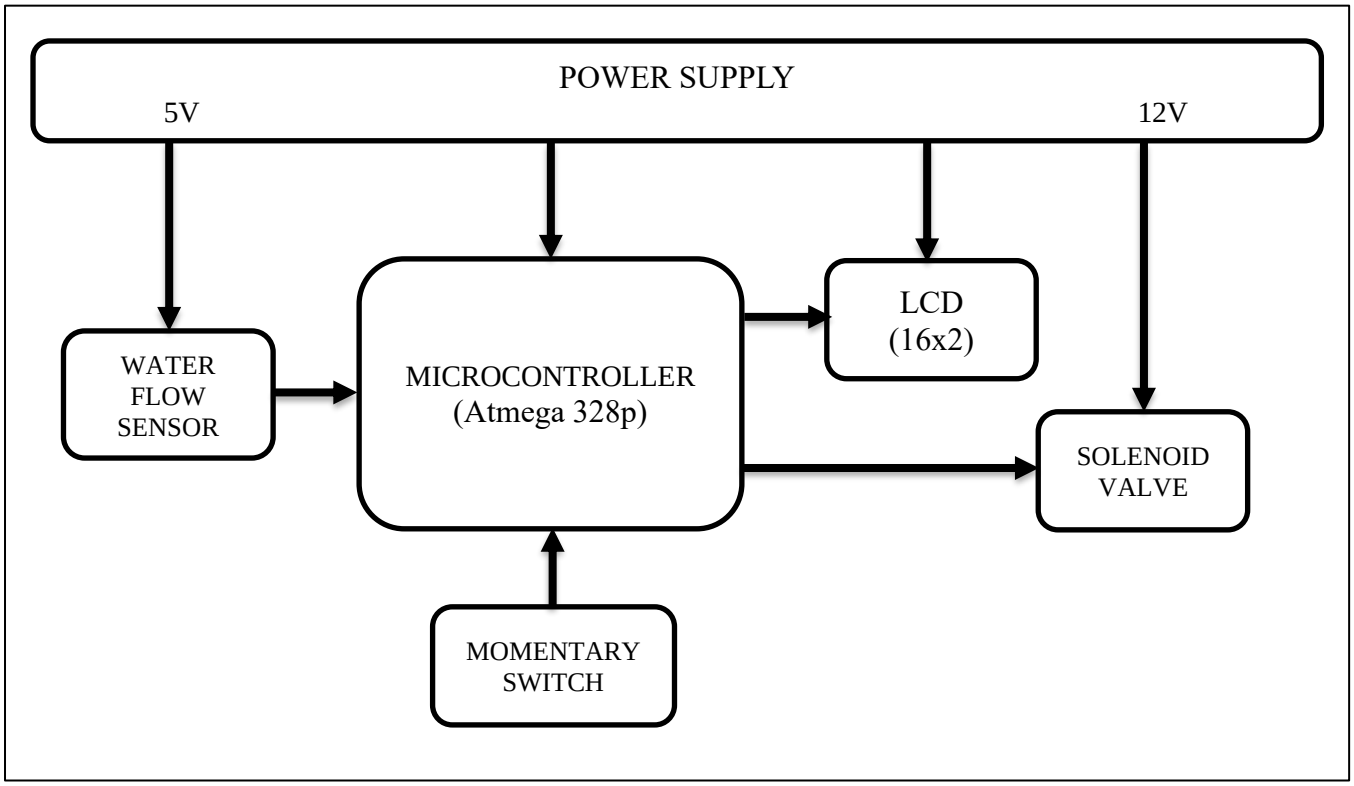

Fig.2 Block Diagram

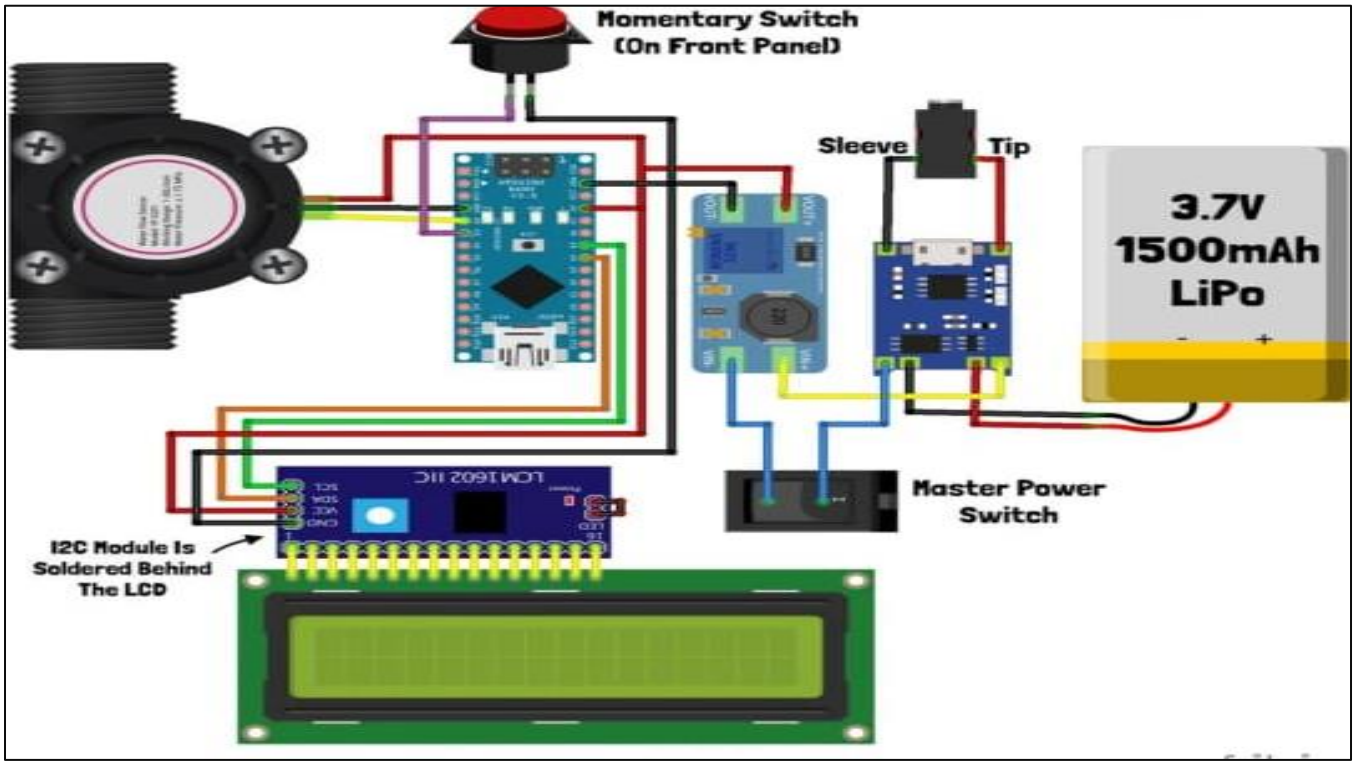

Fig.3 Circuit Diagram

6. Problem Definition:

Water scarcity in India is an ongoing water crisis in India that affects nearly 600 million people each year. India has only 4% of the world's freshwater resources despite a population of over 1.3 billion people that is 17.7% of the world's population. Several large cities of India have experienced water shortages in recent years, with Chennai being the most prominent in 2019. The shortage of water affected the entire city of 9 million people and resulted in the closure of several hotels, restaurants, and businesses. In June 2019, 65% of all reservoirs in India reported below-normal water levels, and 12% were completely dry. According to a report by the National Institution for Transforming India (NITI Aayog), at least 21 major Indian cities, including the capital New Delhi will completely run out of groundwater by 2020. The report also noted that approximately 200,000 people die in India each year due to the lack of access to safe drinking water.

One of the reasons for water scarcity is the excess wastage of water. Knowingly or unknowingly, we waste water every day. We are not conscious about the wastage while performing our daily tasks. Not turning off the tap while brushing teeth, or while shaving, leakage, washing vehicles with fresh water are some of the paradigm of how we are wasting water on a daily basis. According to a report in India, an average person wastes about 0-45 liters water per day. To understand it better, it is 30% of the water requirement per person per day.

7. How our product aims at solving this problem:

- The water usage monitor will constantly add up the daily water usage to show the monthly usage along with the daily usage.
- The LCD display the shows the actual water usage will tell people when they have reached their limit.
- The automatic cut-off of water supply will help in reducing the per person water usage by forcing people to stay under their limits.

8. Technical aspects involved in design and implementation:

The details of components shown in flowchart is as follows:

a) **Power Supply**: - A 12 Volt power supply is provided to the Solenoid Valve using a SMPS powered by 230V AC supply and 5V power is provided to the remaining circuit using a battery. The same 5V is supplied to the microcontroller as well.

b) **Arduino**: - The usage of Arduino is to read the inputs from the water flow sensor and respectively provide the pre-programmed output signals to the LCD and Solenoid valve.

c) **LCD Display**: - The output or the water flown over time is displayed on the 16*2 LCD display with real time water flowing rate.

d) **Water flow Sensor**: - The water flow meter comprises Hall Effect Sensor which works on the principle of Hall Effect to determine the flow rate of the water by counting the rotations per minute of the Propeller inside the meter and further for calculations of the actual flow rate is done according to the RPM date.

e) **Solenoid Valve (Normally open)**: - A solenoid valve is an automatic valve which when provided a potential difference closes (in the case of normally open valve) the valve to stop the flow of water through it.

f) **Boost Converter**: - The Boost converter converts a low DC voltage to high DC voltage.

g) **TP4056 Charging module**: - TP4056 module is used for the battery charging at a uniform rate and it also has a full charge LED indication.

9. Phase wise work details:

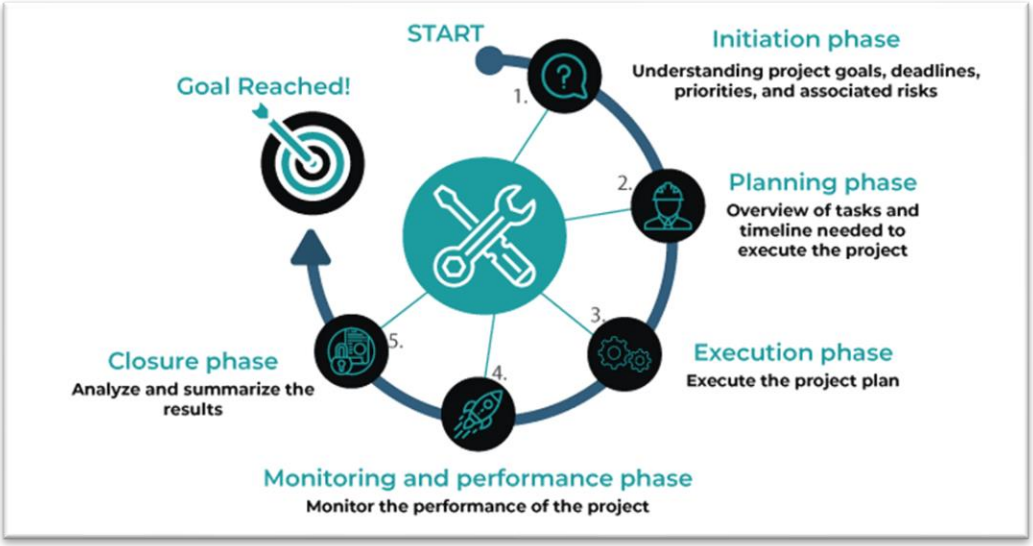

Fig 4. Phase wise work details

Phase 01: Initiation Phase

In the first phase of making the project, initially we identified the need for making this project which was to save the water. As we observed that people around us uses water without understanding the need to save it. Then we documented some possible solutions. Then we conducted a feasibility study to investigate whether each option addresses the project objective and a final practically applicable solution was determined.

Phase 02: Planning Phase

In the second phase, we had to make a soft layout of the project and optimize the cost of our project by selecting the components with the best balance between cost and efficiency. The circuit diagram and project structure that we created was then minimized for compact size by selecting components that were small in size and offered the same performance.

Phase 03: Execution Phase

In the third phase, we bought all the components and made a prototype to observe their proper working. Then we made a box to hold all the components together and attached the screen and button to the outside along with a charging port to the side of the box. Then we started programming the Atmega 328p controller to obtain the readings as accurate as possible.

Phase 04: Monitoring and Performance Phase

In the fourth phase, the testing for digital water usage display was started in our own homes and the results were mostly accurate. We connected the project with a shower nozzle and a water pump. A predefined volume of water was displaced through the shower nozzle and the readings were displayed on the screen to know the accuracy.

Phase 05: Closure Phase

In the fifth and final phase, we concluded that our project is working as intended and now it is time to test it in practical scenarios. Still there are some areas which can be improved such as connecting our product to the internet.

10. Market Analysis:

First and foremost, we are working with a technology which is very cheap and almost very easy to install. It can also be installed in places where the plumbing system has already been built. By using our product almost everybody will start saving water and everything will be done automatically.

a) Target Customers-

- Townships
- Apartments
- Colonies
- Company Buildings

b) Unique Selling Preposition-

- Saves Water
- Reduce manual control
- Compact and looks unique
- Uses minimal power
- Cost Efficient
- Spreads awareness

c) Positioning Strategy-

First step towards the publicity of our product will be through direct approach. Our initial customers will be our friends, family, local organizations and societies. Further, the approach would be towards apartments, hostels, townships and schools.

Then, for global recognition e-commerce websites and advertisement pop-ups will be employed which would help our product to reach the targeted customers.

11. List of Prospective clients/customers

S. No	Name	Contact No.	Requirement
1	CDGI	+917314243600	For college quarters
2	Prof. K. Srikant		
3	Mr. Yusuf Ali	+919111920069	For his flats
4	Mr. S. Patel	+918959333290	For his row houses
5	Mr. Saifuddin	+919893067275	For selling to customers
6	Chourey Builders	+918085115054	For their townships
7	Global Hardware	+918959385253	For selling to customers
8	Mr. Ankit	+917748069493	For his house
9	Mr. Ali Asger	+918349185136	For his house
10	Mr. Divyansh	+917974228256	For selling to customers

12. Existing Similar products in market:

Fig 5. Existing similar products

13. Comparison:

Existing Products	Digital Water Usage Display
• In our search we have found that most of the products available for water flow monitoring do not provide the feature for automatic cut-off.	• Our product displays the amount of water used as well as cuts off the water supply when the specified limit is reached.
• Most water usage monitors are not made for small scale use.	• Our product can be designed for small scale as well as large scale.
• They are heavy in weight and not easy to setup.	• Our product is light in weight and very easy to setup.

14. Cost Analysis:

S No.	Name of items	Cost (per piece)	No. of items	Total Cost
1	Water flow sensor	330	1	330
2	LCD with I2C	204	1	205
3	Solenoid Valve	490	1	490
4	Li-Po Battery	520	1	520
5	SMPS 12v	450	1	450
6	Switch Socket	59	1	59
7	TP4056 Module	59	1	59
8	Arduino Pro Mini	199	1	199
9	DC Step up converter	110	1	110
10	Wires	47		47
11	Pipe	40		40
12	Manufacturing	700		700
Total				3208

15. Future Innovation we intend to do:

- IoT enabled product
- Automatically a warning message will be sent once the cut-off limit is going to reach soon.

16. Conclusion:

In this digital world, Technology is very advanced and we prefer things to be done automatically without any human efforts and we must also keep in our mind to preserve our natural resources. We all understand the need of water, so rather than wasting it, some solutions to minimize the wastage of water must be developed. So, this product deals with the same problem, it monitors the water usage and in addition it is also able to cut off the water supply after a preset limit. It is very useful in conserving the water and also makes the user aware of their daily water requirements and usage.