WATER CONSUMPTION ANALYSIS USING HOME AUTOMATION

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PROJECT GUIDE

PROF. YOGITA GANAGE

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ABSTRACT

- Water is scarce and valuable resource hence proper management of this resources is essential for social and economic development of any country because it is an input to almost all production in key sectors like Agriculture, Industries , Energy and Transport.
- Only sector with needs this importance is the society and public consumption sector.
- Smart devices have transformed nearly every aspects of our house and we are presenting a practical low-cost Smart Water Meter Device.
- Our Device includes Sensor which works on the principle of the Hall-effect. According to the Hall Effect, a voltage difference is induced in a conductor transverse to the electric current and the magnetic field perpendicular to it.
- Here, the Hall Effect is utilized in the flow meter using a small fan/propeller-shaped rotor, which is placed in the path of the liquid flowing.

INTRODUCTION

- Water crisis referring to scarcity of freshwater resources has become one of the major challenges throughout the world. This has resulted from many interrelated issues such as population explosion, and climate change.
- The global population has increased from 3 to 7 billion people in five decades , placing considerable pressure on water resources. It is estimated that by 2025, 67% of the global population will face moderate to high water stress and half of the population will be suffering constraints in their water supply.
- India, as one of the largest countries in the world with a population of 1.2 billion, can be classified as a hot tropical country. A large proportion of the Indian population lack access to safe drinking water, and as a result of growing population, this situation has deteriorated.
- Poor management and overexploitation of groundwater by all sectors in the absence of adequate regulation and effective pricing instruments severely impact water-scarce areas .
- Domestic water demand accounts for 80 percent of groundwater use, and GR projects the situation to worsen over the coming years.

LITERATURE SURVEY

Introduction

- Irish Water require estimates of household water consumption and water consumption differentiated by the number of persons in the household. While some data on household water consumption has been collected in Ireland by Group Water Schemes, this data is not available for closer analysis.
- For this reason, Irish Water collected data on water consumption for a sample of households where water meters had been fitted early (Phase 1). Data for a second sample was also collected where the number of children is identified (Phase 2). This note outlines the analysis undertaken using this data collected by Irish Water to identify per capita water consumption for different household sizes (Phase 1) and the difference between the consumption of adults and children (Phase 2)1 In particular it describes the data collected in the two phases and identifies the water consumption patterns observed in the samples. The analysis considers the influence of unusual data points – outliers – and also adjusts the results for differences in the distribution of household sizes in the samples compared to the CSO Census of Population 2011.
- 2. Per Capita Water Consumption by Household Size The data collected by Irish water as part of Phase 1 encompasses 1650 households. Apart from household water usage which is based on meter readings for a three month period, the data includes details on the property type, the number of persons in the household and the number of bedrooms of the property.
- The largest household size includes households with six or more persons so that households with more than 5 individuals are not identified by the exact number of persons per household.

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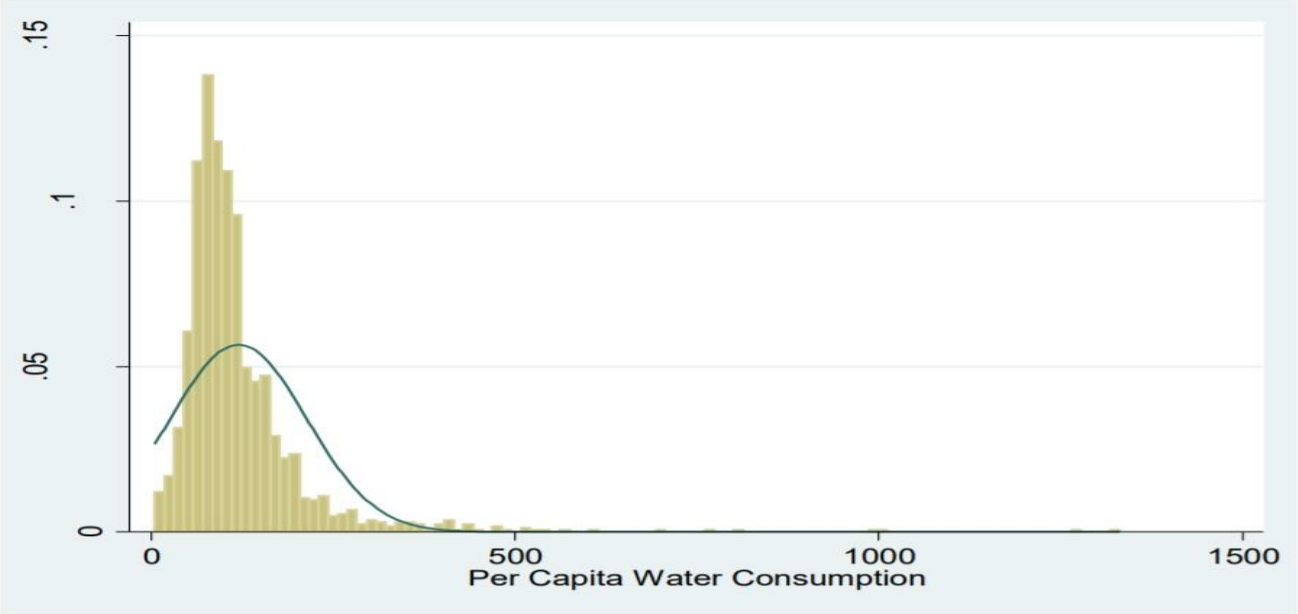
Table 2.1 shows the breakdown of the households by number of bedrooms in the property and property type. just 5 households live in one bedroom properties and just 34 apartments are included in the sample. In the subsequent analysis no significant relationship between water consumption and the number of bedrooms and the housing type was uncovered, suggesting that for this sample at least these variables do not determine water consumption

Table 2.1. Distribution of the Sample by Number of Bedrooms and Type of Property.

Bedrooms	Number of Households	Type	Number of Households
1	5	Apartment	34
2	150	Detached	456
3	840	Semi-detached	774
4	580	Terrace	386
5	75		
Total	1650		1650

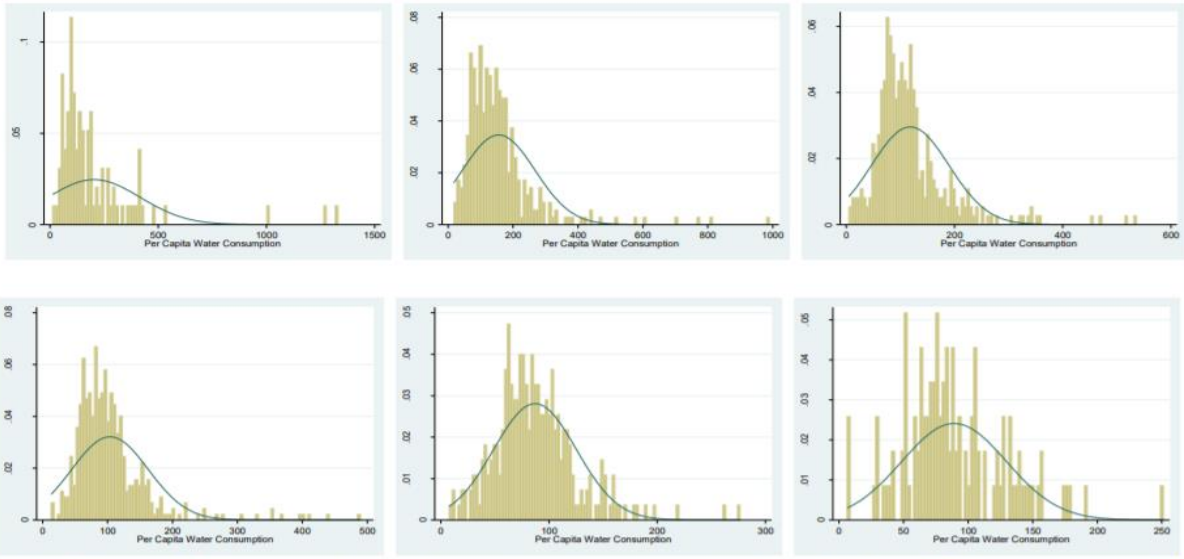
The key issue of the analysis here is the level of water consumption per person.
A histogram of the distribution of per capita water consumption across all households is shown in figure 2.1 for different occupancies.
The horizontal axis measures the per capita water consumption and the vertical axis measures the fraction of the observations in the sample at each level of water consumption.

Figure 2.1. Histogram of Per Capita Water Consumption Across all Sampled Households (with normal distribution superimposed)



The distribution plots indicate not only that the data observed in the sample is not normally distributed but that there are also observations that are uncharacteristic in terms of water consumption given the distribution of the sample.
Such outliers can have a significant influence on the estimated average water consumption.

Figure 2.2. Histograms of Per Capita Water Consumptions for Households by Household size



Note: The top left corner shows the water consumption of single households corner and the bottom left corner shows the per capita water consumption for households with six or more persons.

DRAWBACKS

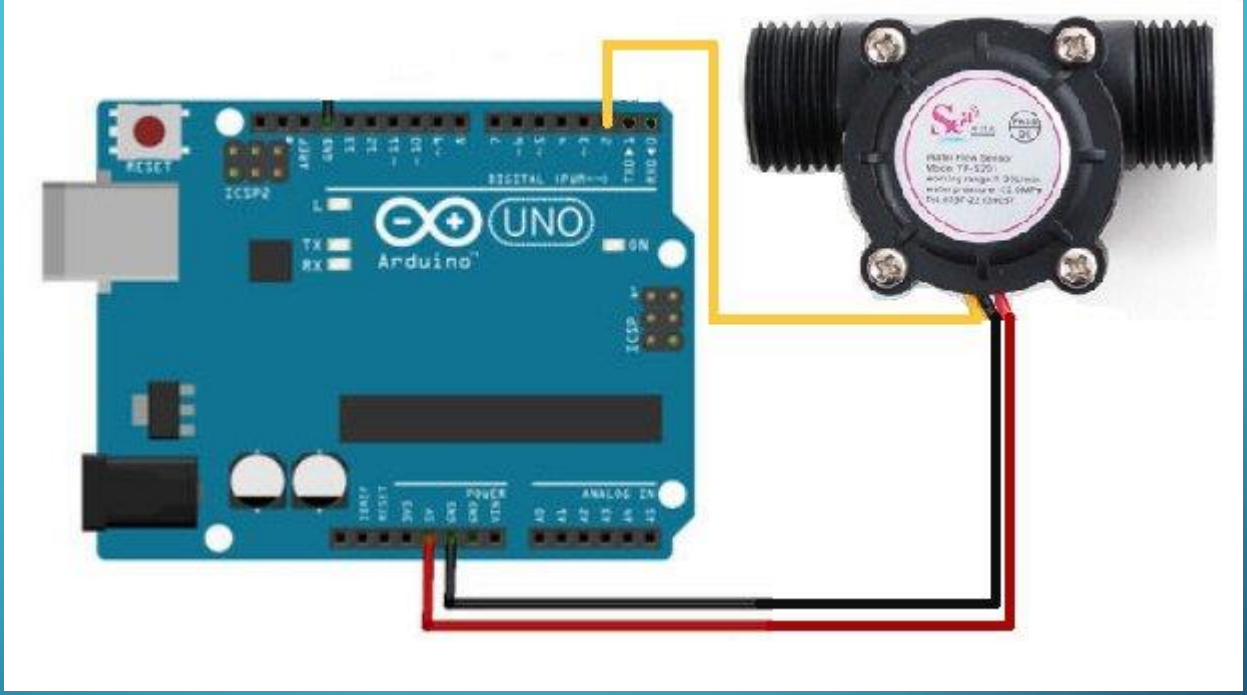
- Irish Water require household water consumption and water consumption System was costly for implementation.
- **The system was not user friendly.**
- **No real time data was provided.**
- **System did not have easy access.**

METHODOLOGY

- The Arduino flow meter works on the principle of the Hall effect. According to the Hall effect, a voltage difference is induced in a conductor transverse to the electric current and the magnetic field perpendicular to it.
- Here, the Hall effect is utilized in the flow meter using a small fan/propeller-shaped rotor, which is placed in the path of the liquid flowing.
- The liquid pushes against the fins of the rotor, causing it to rotate. The shaft of the rotor is connected to a Hall effect sensor. It is an arrangement of a current flowing coil and a magnet connected to the shaft of the rotor, thus a voltage/pulse is induced as this rotor rotates.
- In this flow meter, for every liter of liquid passing through it per minute, it outputs about 4.5 pulses. This is due to the changing magnetic field caused by the magnet attached to the rotor shaft as seen in the picture below.
- We measure the number of pulses using an Arduino and then calculate the flow rate in liters per hour (L/hr) using a simple conversion formula.

- ***Connecting the Arduino to the Flow Rate Sensor***

- The connections required for this flow rate sensor with respect to the Arduino are very minimal. There are only three wires coming from the flow rate sensor.
- The 5V VCC (red wire), the GND (black wire), and the signal/pulse (usually yellow) line. Connect the VCC and GND of the flow meter to the Arduino's VCC and GND.
- The pulse line of the flow rate sensor is connected to the Arduino's digital pin 2.
- The Arduino's digital pin 2 serves as an external interrupt pin (interrupt pin 0). You have hooked up your flow meter to the Arduino!

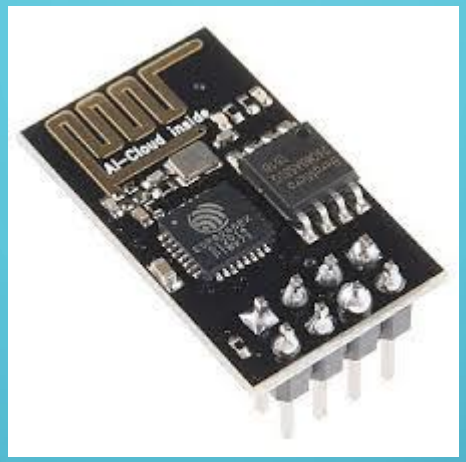


Connections

HARDWARE AND SOFTWARE REQUIREMENT

YF-S201 Water Flow Module

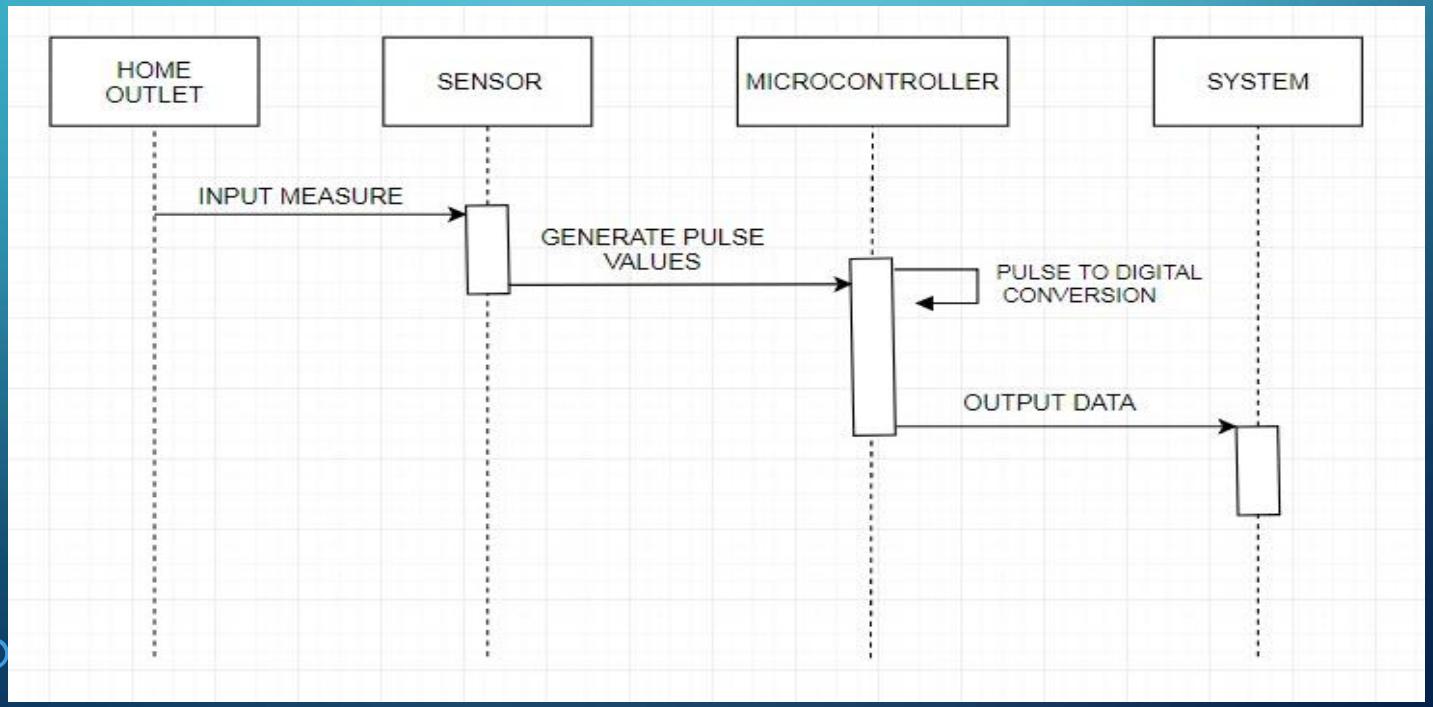
Arduino Uno



ESP 8266 Wifi Module

PROCESS FLOW DIAGRAM

- A process flow chart is an instrument that visualizes and analyses the various systems and procedures



WHY DO WE NEED A PROCESS FLOW DIAGRAM IN OUR PROJECT?

- Here we have used sequence flow diagram to show the procedure that the output terminal.
- We have 4 major components:

1. home outlet
2. Sensor
3. Microcontroller
4. System

- Home outlet sends the input measure of the water flowing through the pipes of houses.
- This input measure is sensed at the sensor level; thus generating pulse values at sensor level.
- The pulse values are converted into digital data as required by the system with the help of microcontroller.
- The microcontroller at it's final step, sends the digital data to the system as the final output of our project.

GOALS

- Our project's goal is to investigate the weekly per capita indoor water use of the Societies in an effort to better understand water demands, as well as the best methods to increase water efficiency and conservation.
- This will be done by individually tracking personal indoor water use. The data gathered will then be used to compare and contrast average overall household water usage to that of the Individual Society. Doing this enables individuals to gage how much of an impact they have personally on the water system they draw from.
- Commercial Water losses has proven to be on rise and the two major contributions have been billing errors and high water consumption .Billing errors occur as a result of inaccurate water meter readings and at times due to lack of man power to acquire the actual water consumption rates which leads to poor data handling .An increase in water consumptions levels in many cases are caused by dripping taps ,running toilets and pipe leakages.

REFERENCE PAPER

- Papers

1. A Data Mining based Model for Detection of Fraudulent behavior in Water Consumption.
2. Design of a water flow and usage meter.
3. A study of individual household water consumption

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2. [2] N/A, “Water Reallocation Policy, Ministry of Water and irrigation of Jordan”. Technical Report. 2016.
3. [3] C. Ramos , A. Souza , J. Papa and A. Falcao, “Fast non-technical losses identification through optimum-path forest”. In Proc. of the 15th Int. Conf. Intelligent System Applications to Power Systems, 2009, pp.1-5. [4] E. Kirkos, C. Spathis and Y. Manolopoulos, “Data mining techniques for the detection of fraudulent financial statements”, Expert Systems with Applications, 32(2007): 995–1003.

Glad to Answer Questions ☺