Certain Investigations and an experimental approach for the kerbside Rainwater collection

Mythili S1, Kalamani M2, Krishnaraj R3, Soundarya B4

Department of Electronics and Communication Engineering,

1,3,4 Assistant Professor, Bannari Amman Institute of Technology, Tamil Nadu - 638401
3 Professor, Velalar College of Engineering and Technology, Erode, Tamil Nadu, India

mythilikarthikeyan911@gmail.com, kalamani.mece@gmail.com, krishnarajr@bitsathy.ac.in, soundarya@bitsathy.ac.in

Abstract. Rainwater is a free and renewable source used for domestic purposes but due to storage constraints, 36% of rain water is used in India even though heavy rainfall occurs during monsoon months. Nowadays the roads and their development in city environments are incalculable. The outstanding backlog is that most of the time, the drainage is filled by rain that falls on roads lead to less possibility of rain water usage. This work describes of saving rain water via external sensor-equipped pipes attached to the roadside. Whenever rain water fall on sensors it will be sensed, so that the pipes will open and rain water will fall through the fitted pipes and further it is transferred to storage tank with the aid of servo motors and DC motors. Through this prototype construction the rain water quantity of 55% is getting saved and also supports for ground water recharge

Keywords- Rain water; Sensor, Pipes; Storage tank; Motors; Road

1. INTRODUCTION

There are many signs of temperature changes in India, especially from the point of view of the water environment. The Environment Ministry has issued a study on the consequences of variation in climate and its adaptation plan. One of the implications is that the shift in weather trends as well as the oversized annual precipitation and its variations that are either too small or too high and the increase in precipitation is abruptly important. The same is true to the effect of water resources such as rivers, reservoirs and ground water, including a drastic change in water volume, a rise in water temperature and a decrease in water quality. In addition vulnerability to floods and droughts as a result of climate change is growing in India. The study referred to the value of rainwater harvesting and reuse of water as a counter-measure for the future of water demand and water supply. As per the Ministry Water Management in India the total yearly rainfall is estimated as 4000 billion m3. India is the world’s largest user of groundwater accounting for more than 60 per cent of agricultural production and 85 per cent of aquifer dependent water sources. Input and Inflation rate plans support crops such as wheat that are water efficient. The amount of rainwater usage is still limited, there are a variety of feasible initiatives to encourage fresh water storage and to collect grants from global to municipal councils, subsidies from municipal authorities to personal entities and low interest loans for facilities in Indian cities.

Over the years, storm water conservation and harvesting technology has gained interest and emerging for maintaining and regulating water supply under the climate change crisis. Betting on various policy decisions rain water storage and harvesting system in addition the purpose of municipal miscellaneous usage in India has recently been to minimize floods. To drive down rainwater retention and collection it is crucial to quantitatively analyze their optimal operation and facility performance. It
is also necessary to estimate the proportion of fresh water on the surface resembling a roof in the aimed areas. Stream flow modeling requires a valid identification of ground levels with various precipitation losses as the metropolitan area is populated by different surface forms.

The exceptional advances have served as a potential alternative which is defined under the related works. The later part of this paper sets out a plan for the execution of this project. This research would benefit advanced different hydrological modeling and the evaluation of fresh water storage facilities and on road harvesting facilities.

2. RELATED WORKS

In [1] the author proposed a system through which the rain sensor has been used and the measured level is given to arduino microcontroller to store the rainwater. The shortcomings of this system is there is no rainfall level margin due to this it will not sense properly under the low level rainfall condition and the system is not supportive if there is a case of heavy rainfall. In [2] the author suggested a way for rain water harvesting through the usage of servo motor and flush mechanism stored into the underside of the road called sump. Here the reaction time is quite low and it affected by many external environmental factors. The paper [3] discusses about the techniques to solve the water issues with the help of sensors and detection techniques with the help of camera. This system is quite cost effective. Few authors discusses about rainwater filtering by the removal of turbid and by some reacting agents for the portable usage and for the underground storage. This sort of water treatment helps for the purpose of storing and reusability. This cannot distinguish all kinds of particles that are unwanted to the use. The exact existing system [4, 6] implemented a new trend to encourage rainwater conservation and harvesting. In addition the need for rainwater for the distribution of water to the warmed pavement road is illustrated which has recently been implemented to alleviate urban thermal insular phenomena. The final portion of the existing work presents a recent analysis on the comprehensive land cover classification for including the separation of the roof form using satellite image and GIS data.

3. PROPOSED SYSTEM

The system comprises of many hardware components like rain sensor, arduino microcontroller, servo motor, Connecting pipes and DC motor. Raindrop sensor is essentially a panel in that nickel is applied in the pattern of a line. It is working on the principle of resistance. It functions like a switch and the underlying concept is that the switch is closed when there is rain. As a consequence, servo motors are used to control the location of objects, rotate objects, shift robots' legs, arms or hands, move sensors, etc. with high precision. The servo motor is composed of Direct current generator or Alternating Current generator, the potentiometer, the gear assembly and the control circuit. Initially, the gear assembly is used to reduce the speed and raise the engine torque. In the initial phase of the servo motor shaft, no electrical signal is produced at the output port of the potentiometer. The electric impulse of the error detector amplifier is now provided to another input terminal. Then the difference of it will be feed in a feedback system and output will be interpreted and analysed in terms of an error signal. This error signal is used as the engine input and the engine begins to rotate.

The most popular DC motor simply called rotating electric motor are dependent on the forces of the magnetic field which has an internal electromechanical or electrical function leads to periodical change in the current direction of the motor. Large DC motors are currently used to drive electric cars, lifts and winches as well as steel rolling mills.
The working methodological steps are listed from sensor connection to storage tank.

- First vertical is to open the pipe using rain sensor. When rain water falls on sensor, it will sense by sensor and the signal will transfer to the arduino board where the sensor connected, then the arduino board switch 'ON' the servo motor so the pipes get open and rain water go through that.
- The second vertical is to move water with the help of motor. The rain water then move forcibly by the dc motor fitted inside the pipe to the rain water filter tank.
- Third vertical is to store the rain water in tank. The rain water moves downward from surface to ground through filter tank to recharge the groundwater else it can be stored in storage tank for future use.

The figure 1 explains the entire flow of the proposed rain water storage system.

![Flow map illustration involved in the process of context rain water storage](image)

**Figure 1.** Flow map illustration involved in the process of context rain water storage

4. RESULTS AND DISCUSSION

The rain Sensor module shown in figure 2 enables the measurement of moisture by analogue signal pins and generates a digital output when the humidity threshold is exceeded. The module is based on an op amp for the LM393. It is founded on the principle of absolute internal reflection. The small servo motors can be attached explicitly to the arduino to regulate the location of the shaft very precisely. It helps for the road side pavement to ensure the module setup is in appropriate position. With the help of external pipes and sensors the rainwater can be saved.
Figure 2. Experimental setup of the raindrop sensor connected to a powered Arduino with its physical configuration and operational efficiency of the circuit by flashing light

Figure 3. Model of road layout and pavement space marking for the implementation of the proposed rainwater saving system

The research is experimentally done with certain considerations that the road width is 7.6 metre in India and assumption of one litre rain water is being accounted for one metre road distance. The deployed system road structure and its marking prototype is shown in figure 3.

The operating theory and use of energy are much smaller. The scenario set up and the preferred hardware supported to achieve cost effective system with simple construction. The installation of the entire setup is also quite convenient. The chances of false detection are also less. The drawback of the system is that the sensor will detect only when rain water falls on it directly.

5. CONCLUSION AND FUTURE SCOPE

In order to facilitate the implementation of rainwater storage and harvesting systems in the next level to improve the ground water level this prototype model has been designed and implemented with short road dimension of 7.26 metres. The comprised hardware with sensor module sense the rain water and
lets it to travel to the storage tank with the aid of servo motor and the DC motor regulated by arduino microcontroller. Thus the 55% of road side accumulated water could be stored for future use.

There is a large necessity for rainwater storage required for municipal purposes, flushing toilets, land drainage and irrigation roads and plants. In an extended perspective this form of rainwater harvesting can be carried out in the simplest way if the road structures are sloping so this slope helps to transfer the accumulated water directly to the pavement setup. Roof top rain water storage is also possible with the help of sensor network and further the water purification is possible by transferring the stored rainwater into the filter tank with the aid of servo motors attached to it for future needs.

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