

DEVELOPMENT OF SMART SYSTEM FOR RUNOFF MEASUREMENT

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ABSTRACT

Key Word: Smart runoff measurement system, Runoff measurement, Runoff plot, IoT in Agriculture, Ultrasonic sensor

The experiment was conducted at Instructional Farm of Department of Soil and Water Conservation Engineering, College of Agricultural Engineering and Technology, Junagadh. Accurate Estimation of peak runoff rate is a very important task for the design of hydrological structure and watershed management, such as the design of drains, canals & other channels. Estimation of runoff volume or runoff depth is one of the design parameters for irrigation storage structure. Runoff plot is used for the estimation of runoff volume and to find out peak runoff rate from hydrograph. Various experiments also conducted to find out the effect of soil type, cropping pattern and slope on runoff. Sometimes this runoff plot is structured at a remote location. So, It is very difficult to measure runoff depth in adverse weather conditions and at night time. Smart Runoff Measurement System is very useful in this type of condition.

So, there is a need to develop a smart system for the measurement of runoff using the concept of IoT (Internet of Things). Ultrasonic sensors with a microcontroller can be used as a depth measuring device in runoff tanks. These sensors record the raw data and communicate with the microcontroller to generate the actual depth using various functions. The processed data is sent to the Wi-Fi modules by communication protocols to provide remote access to data. This Wi-Fi module works as an internet gateway and sends sensor data to the webpage. The webpage is used for data visualizations and data storing purposes. These data can be further used for analysis.

A performance evaluation of an ultrasonic sensor was carried out in this study. Ultrasonic sensor programmed by three methods. The mean absolute error of distance measured using NewPing Library is 4.5 mm and the relative error is 0.71%. The mean absolute error of distance measured using NewPing Library with iteration method is 5.25 mm and the relative error is 0.97%. The mean absolute error of distance measured

using NewPing Library with temperature effect equation method is 3 mm and the relative error is 0.63%. Hence, Newping Library with temperature effect equation method to program Ultrasonic sensor gives the best accuracy and it is recommended to use.

The total cost of the developed smart runoff measurement system is Rs. 10040/- . Considering the CRF approach, the annual cost of the system can be Rs. 2638 /year which is very less as compared to the annual cost of Rs. 50000 for paying a salary of one person to measure and record data during the probable 5 rainy months of the monsoon season. The IoT based developed smart runoff measurement system can be a very cost-effective and efficient system for the monitoring of runoff inflow for the various topographic conditions, land use, soil types, etc. The developed system can directly store runoff data in cloud storage and obtained at our place for further processes.