Design of a Smart Raingauge for Rainfall volume and Intensity

by

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EXECUTIVE SUMMARY

Arising from the necessity to design a cost effective and efficient sensor, an inexpensive smart rain gauge has been designed to meet the aid sensor station distribution across sub Saharan Africa

To measure the rainfall per time, a standard rainguage cylinder with a diameter of 20cm and a height of 50 cm is filled to the height of 1mm of rain water. The water is then emptied into a ready made local pipe with a tap, and of having diameter of 2.5cm.The height of the water in the local pipe is marked and a water detector electrode is inserted at that height. A 20 cm diameter funnel is inserted into the local pipe to collect rainfall. A microcontroller constantly monitors the pipe, such that when the rainfall water reaches the marked height, hence connecting the electrode, a signal is sent to a servo motor to open the valve which is attached to the bottom of the pipe, for a time sufficient for the 1mm volume of water to drain off, after which it is closed. A reading of 1mm is recorded and accumulated every time water gets to the electrode to know the amount of rainfall for a certain time which could be days or month.

The cost of producing 20,000 unit of the rain guage is less than $10, and it proved to work excellently .

1.0 Introduction

Seed (2014) reports that the “official” rain gauge specified by the United States Weather Bureau is a 50 cm tall cylinder with a 20 cm diameter funnel as shown in the figure below. The amount of rain fall for a particular time is the height of the water in the cylinder after certain duration of time. In other to take the rainfall data for another or time, one has to manually empty the cylinder.

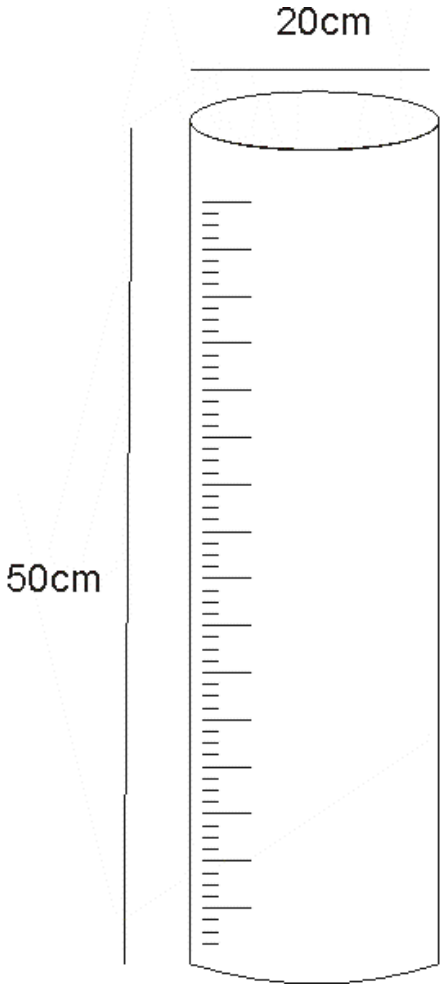

Fig 1: The Standard Rainguage

1.1 The Design

The design of the smart rainguage involves collecting the volume of 1mm height of rainfall from the standard rainguage. The water is poured into a pipe of 2.5cm diameter, which has a valve controlled by a servo motor. The height the water makes in the pipe is marked and an electrode is inserted at that level to detect water. When water gets to the marked level, it closes a circuit thereby sending a signal to the microcontroller as illustrated by the fig2 below. This further allows the microcontroller to actuate the servo motor to open the valve for a very short period of time to allow the water to drain. 1mm of rainfall is therefore recorded on each occasion and will be accumulated for the specific time of rainfall.

A closing cap is positioned just above the electrode, such that while the 1mm of water is been drained, it is closed to allow water to be collected during draining and opened when the servo motor closes the valve. An electrode connected to the bottom is also used to detect the presence of water.

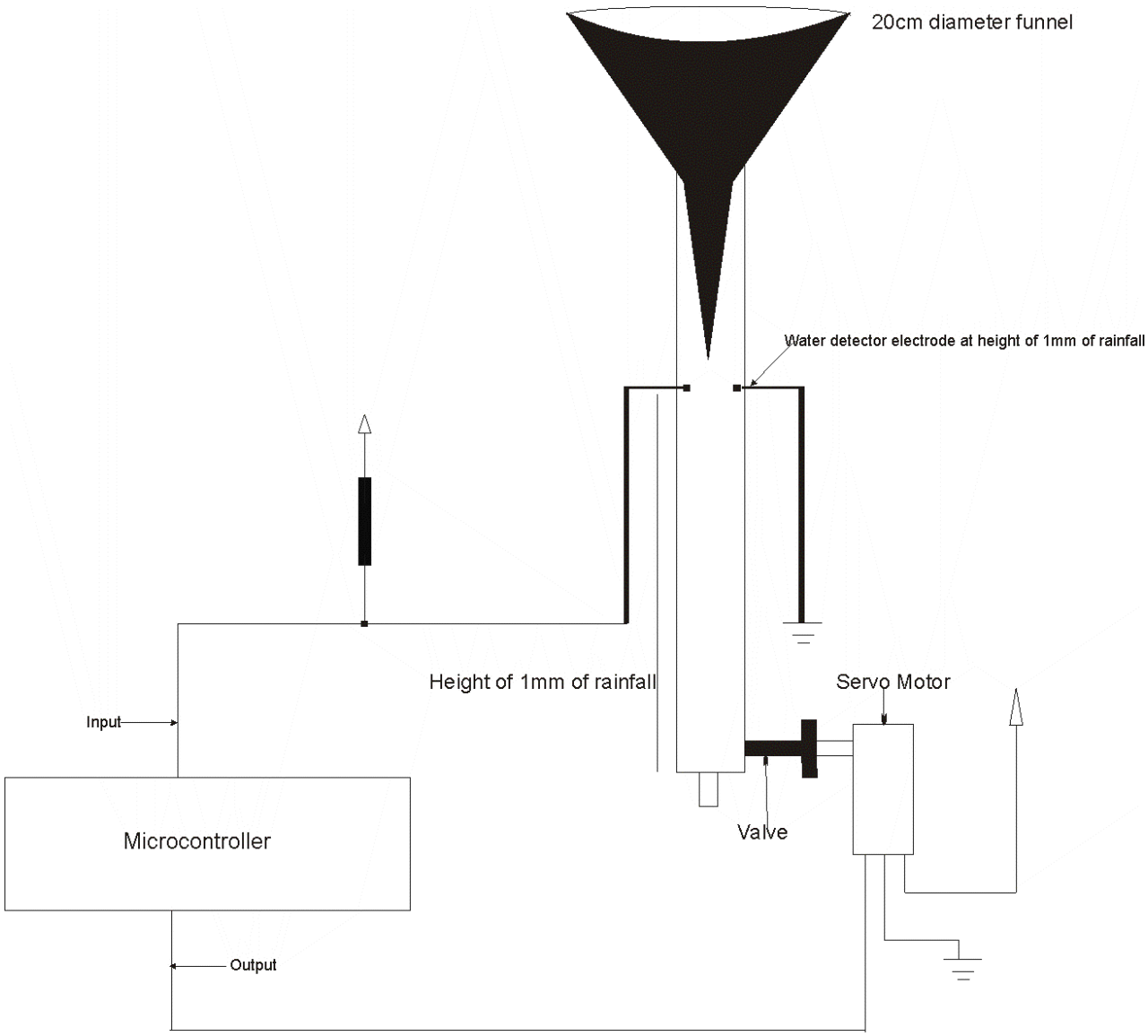

Fig 2. Smart Rainguage.

Timing facilities are implemented by the microcontroller to know the intensity of rainfall given by **Signal Receive from electrode by microcontroller (mm of rainfall) per hour.**

Table 2. Component Cost Analysis

COMPONENT	PRICE (USD)	QUANTITY	TOTAL
Pipe **2.5cm Diameter**	1.03	1	1.03
Funnel	0.6	1	0.6
Servo Motor **SM23/33 Series (SM-S3317M)**	4.06	1	4.06
LED **Red Light**	0.03	1	0.03
Tap Actuator	2.0	1	2.0
Microcontroller	1.2	1	1.2
Resistor **220 ohms**	0.03	1	0.03
Connectors **Connecting Wires (100cm)**	0.5	1	0.5
TOTAL			**9.45**

* Prices are sourced from local electronic stores and are expected to be cheaper when sourced from manufacturing company

1.4 CONCLUSION

The smart rain guage Sensor worked fine and read accurately rainfall measurement when compared with standard rainguage that is expensive.

1.5 REFERENCE

Seed (2014) , www.seed.com 2014.