RAINFALL MONITORING USING ARDUINO WITH IoT

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ABSTRACT

A Rainfall monitoring system is designed to effectively estimate the intensity of the rain. So as to take necessary precautions in the event of rain related disasters. By the means of a tipping bucket rainfall is measured. The function of a tipping bucket rain gauge is to measure the amount of rain water that falls on a certain surface of the earth with a certain time range as well. The amount of rain fall is generally measured using units of mm per time. The occurrence of the tip is recorded and then transmitted as number of tips and the rate at which they occur .These results are transmitted from the arduino through the Wi-Fi module to a cloud platform where it can be viewed at users end.

Keyword : -*Tipping bucket, Arduino, Wi-Fi module*

1. INTRODUCTION

Heavy rainfall is one of the most widespread severe weather hazards which can result in floods, landslides etc. this can deal catastrophic damage to the affected area. Timely response and precaution is more crucial to keeping the damage brought about by heavy rainfall. The effects of heavy rainfall span from spreading of diseases due to motionless water, to the destruction of house, cars and even the economy. Studies suggest, flooding causes more deaths than any other hazard related to rainfall since water levels rise so quickly catching its victims off guard. Flood has unfavorable impact on human health, environment, cultural heritage and economic activities. If there is heavy rainfall there is less chance of invade so it runs off into the river or lakes or any other water bodies. The faster the water reaches the river or water bodies ,the more likely it will flood. Drains and sewers system takes water directly to the river which increases the flood risk. There is very large amount of land, which drains into one large or in this case subsequently smaller rivers or stream. The stream will overflow and cause widespread flooding. Flooding is a long term event and may last a week or more. Even a little bit of delay towards taking precautions can complicate rescue operations since treading on flood water itself without protective layers can expose to the risks of infections and other disease.

Water is an essential resource several studies has been conducted to understand rain the passage of rainfall through a particular area is a dynamic process, it will change the intensity and shape of rain. The measurement and sensing of the amount and type of rain helps us develop a detailed description of rain physically and dynamically. So a better study of our environment and preparing for possible environmental disasters such as droughts or floods. The main aim of water management from rainfall is to reduce economic impact and risk of lives. Most of the developing countries depends on rainfall for their water needs. However if the management of rainfall water is poor, it is difficult to determine water losses to ground ,water recharge and how much is still available etc. Therefore rainfall measurement and monitoring is an important factor. A rainfall monitoring system will continuously measure rainfall and transmit the data to a platform where emergency services or weather experts can alert the residents of the locality, which is threatened by the impending rain related disaster.

The primary objective of the project is to measure precipitation over an area and to alert its occupants if the rainfall exceeds to a dangerous scale. Reliable rainfall monitoring system is a key for any water system analysis and for operational water system control. Rainfall is measured using gauges which are manually read or automatically send data to a network using wireless communication system.

The system consists of a Tipping Bucket Rain Gauge, an arduino board, Wi-Fi module and temperature as well as humidity sensors. The key hardware here is the Tipping Bucket Rain Gauge which collects and measures the rainfall. The acquired data is processed and transmitted with help of an arduino module where the intended recipient can view it. Tipping bucket rain gauges commonly used for measuring rainfall throughout the world.

The tipping bucket rain gauge consists a large cylinder which is connected to the ground .A funnel is placed above the cylinder to collect the rain water .The collected amount of rain water falls onto a lever which is balanced in the same way as a see-saw. After rain water falls, the lever tips. Dumping the collected rain water and sending an electrical pulse to the record. The operating principle of the tipping bucket rain gauge is to counts the number of tips and converts in to the volume of liquid.

2. LITERATURE SURVEY

There are various approaches and technologies used for designing a tipping bucket. The article[1] authors Rajiv Kumar Das and Neelam Rup Prakash has design a tipping bucket rain gauge for the measurement of rainfall as well as for snow precipitation. Here the tipping bucket rain gauge supplies faster rain water and snow water data, they proposes the operating principle of tipping bucket rain gauge. Both the rainfall and snow precipitation are measured. The snow precipitation is measured by antifreeze techniques attached on it. It consist of a catch tube anti freeze reservoir and over flow tube . This snow melts and fall on to tipping bucket there by the amount of snow precipitation is measured, Rain fall is directly allowed to pass to the tipping bucket through the funnel and amount of rain fall can be measured.

IoT based rainfall monitoring and weather monitoring [2]&[3] provides different technologies for rainfall and weather monitoring using IoT. [2] authors OnkarAmale and Rupali they design a rainfall monitoring system for transmitting and receiving data over a cellular network by using GPRS. The main aim of their approach is a proper water management. [3] author Jigar Parmar ,Trishal Nagda, PranayPalav, Hezal Lopez initiate system for weather intelligence. Atmosphere is getting polluted by different harmful gases from many industries and vehicles .The different sensors on the system identifies the temperature humidity and noise in the atmosphere and transmit these data's through Wi-Fi to the users end it can be viewed on different electronic platform.

Different sensors are used for measuring rainfall[4] design and development of an acoustic sensor for the monitoring of rainfall the developed acoustic sensor is an android based. These sensor can upload data directly to the web and it will generate a message to the users or authorities if the rain fall exceeds. Acoustic sensor is used for measuring rainfall and it compliments tipping bucket rain gauge. Monitoring temperature at different points [5], author Saraswathi Saha Anupam Majumdar monitors temperature at different points in a data center making this temperature data is visible over internet through a cloud based platform and generates SMS to the predefined user. It will generates an alarm when the temperature range varies from the safe thresholds the data center managements actives and takes necessary actions. These data's can be viewed at any where any time over an online platform.

Structure of rainfall time[6] is explained by n index , it is important for the studies related to flood . Here explained different techniques to define the time structure of rainfall. The n index is explained as the exponent of the power law and it is related to the average gain intensity over a period. The value of n indicates the prevalence of the rain. Different IoT platforms standards[7] different architecture concepts has been explained. They proposed architectural model SAT- IoT providing solutions for the complex problem.

Data logger[8] is enabled internally to the tipping bucket[8] proposed cheap and efficient tipping bucket with low cost. Rain fall data has been transmitted in each every 24 hours with the help of GSM module. The main aim of this project is to eliminate human needs for the acquisition of the data.[9]Performance test measurement of tipping bucket rain gauge by controlling the water flow rate, it is an experimental method results shows the change in water

flow rate. Design of a flood warning system[10] by prediction techniques it shows the rainfall measurements and flood levels of a selected streets and these data are uploaded to a cloud platform. The proposed system can predict flood .

3. PROPOSED SYSTEM
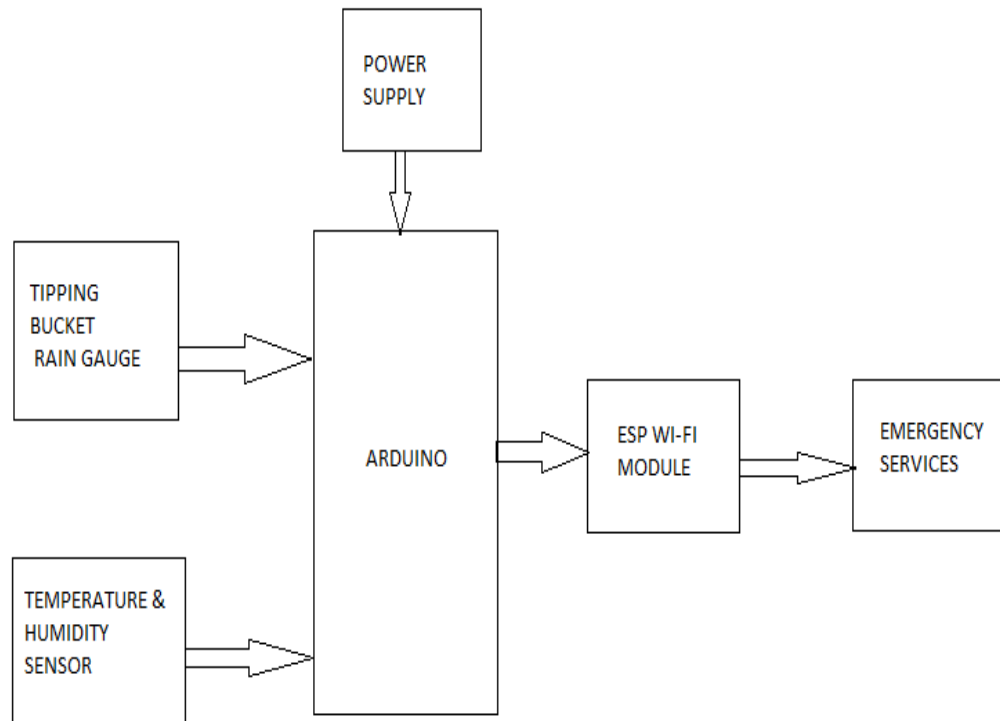
Fig:1 Block Diagram Of The Proposed System

The block diagram consist of a tipping bucket brain gauge ,Temperature and Humidity sensor, Arduino, ESP Wi-Fi module. Tipping bucket rain gauge is a sea-saw like structure.The tipping bucket rain gauge it contains a funnel that collects and passes the rain water into a small sea-saw structured container. After a predetermined amount of water falls through the tip of the lever ,It expels the collected water and send an electrical signal through the reed switch, when it tips it actuates the switch it is electronically recorded and these pulse is given to arduino board .At the same time the Temperature and Humidity sensor detects the temperature and humidity of the atmosphere and it also connected to the arduino. These data's are transmitted via Wi-Fi module to the authorities for further actions. If the amount of rainfall exceeds the particular limit they will alert the public for necessary precautions. Wi-Fi module is capable of hosting an application it contains set of programs. Through Wi-Fi module data's are transmitted to cloud platform where it can be retrieved by the user. DHT22 is used to estimate temperature and humidity of the atmosphere, for communication it uses single bus technology. Collection of information starts when the data sending is end. After the collection of data is finished, DHT22 will switches automatically to the Sleep mode and it will wait for next communication

4. RESULT

The apparatus designed to our specifications should respond to 0.25mm(resolution of tipping bucket rain gauge) of water on the catchment area of the of tipping bucket rain gauge causing it to tip. The system is designed to follow the principle
Total rainfall amount= No of tips × Resolution of the bucket
Hypothetically, if this prototype is subjected to a minute of rainfall, the product of the bucket's resolution and the no of tips occurred is expected to give the measurement of rainfall amount with reasonable accuracy. The no of tips against time is also expected to represent the intensity of rainfall.
These rain fall amount data's are transmitted to the rain monitoring authority they analyze these values if the amount exceeds safety thresholds they will take necessary precautions and alert the public about the situation. These rain fall amount are transmitted to a cloud platforms and these can be viewed by any individuals at any where any time in the world. Along with rain fall amount temperature and humidity readings are transmitted to both the cloud platform and to the monitoring authority.

5. CONCLUSION

To sum up, this paper explores an idea of a simple and cost effective setup that measures rainfall and it's intensity. It also sends this data to concerned authorities so that necessary actions may be taken. Due to it's cheap to manufacture feature, the device can be widely implemented even in remote areas which is one of it's main advantages over the existing model followed by almost instantaneous respone to rainfall. Along with this temperature and humidity readings area also taken ,so user can select the best surrounding environment for the living purpose and for maintaining good health, by monitoring temperature and humidity.

6. REFERENCES

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