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Rain Detector System using Arduino and Rain Sensor

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Abstract: *This work focuses on using rain Sensor, and it can beused in both everyday life and manufacturing. The ultimate goal of this project is to detect rain using a rain sensor. We used 555Ic, which works like a timer, sending a pulse as its signal, which is then read by the buzzer. Everyone's life revolve around water. Water conservation and good use are important. Here isis a simple project that will be sound an alarm when it rains, allowing us to take action to gather rainwater and store it for later use. We can increase the groundwater level with the aid of underwater recharge technologies by saving this rainwater and using it. When the rain detector senses rain, it sounds like analarm. The desired result was achieved in various aspects of using rainwater detector in irrigation home automation, electronics, vehicles, and other field Here is a low-cost rainwater detector circuit that is Simple and effective.*

Keyword: *Rain Sensor, Microcontroller, Arduino-nano,Buzzer, Embedded 'c' language.*

I.INTRODUCTION

A system like this can be used in many different fields, such as agriculture and automobile fields. Rainfall detection can be used to automatically regulate the Irrigation process. Also, continuous rainfall data can help farmers use this smart system to automatically water the crop only when absolutely required. Similarly, in the automobiles sector windshield wipers can be made fully automatic by using the rain detection system. And the Home Automation Systems can also use rain detection to automatically close windows and adjust room temperature. In this tutorial, we will build a basic rain sensor using Arduino with a buzzer. You can then use thisset-up to build anything you wish on top of it. Also, note that the rain sensor module is also referred to as a raindropsensor based on usage, but they all refer to the same sensor used in this project and they all work on the same principle.

We have also built a simple Rain Alarm and an automatic car wiper by using 555 Timer only, you might want tocheck that as well if you do not want to use an Arduino. That being said The Raindrops module consists of two boards, namely Rain Board and Control Board.

let's get back to this project and start building our Arduino Rain sensor. The Rain board module consists of two copper tracks, designed in such a way that under the dry conditions they provide high resistance to the supply voltage, and this output voltage of this module will be 5V. This module's resistance gradually decreases with respect to an increase in the wetness on the board. As the resistance decreases, its output voltage also decreases with respect to the wetness on the module. The Rain board module consists of two pins used to connect to the control board Control Board module controls the sensitivity and converts the analog output to digital output.If the analog value is below the threshold value of the control board, the output is digital low, and If the analog value is higher than the threshold value, the output is digital high. For this comparison and conversion, an LM393 OP-Amp Comparator is used. An Op-Amp comparator is an interesting circuit that can be used to comparetwo different voltage values, we have already used in this circuit in many projects like Smart Electronic Candle, Laser Security Alarm, Line Follower Robot and much more.

The Rain control module which is shown below consists of 4 pins to connect the Arduino namely VCC, GND, D0, A0 and two more pins to connect the rain board module. In summary, the rain board module detects the rainwater, and the control board module is used to control the sensitivity and compare and convert the analog values to digital values.

II. LITERATURE REVIEW

For a number years up till date, some works on Rain water detection have been done by electronic designers/hobbyist. These works range from the application of rain detector circuit/device in irrigation, collecting rain water for domestic and industrial use a process known as rain water harvesting to using rain detector/Sensorin automobiles to control the power windows and roof whenever it senses moisture a design known as automaticrain sensing windows. P. Campbell, et al, [1] in their work, Automatic Rain sensing windows worked to create a device that will allow car windows to roll up automatically when it rains thereby preventing the interior from getting destroyed. The design was essentially used with automobiles. In [2] Campbell scientific built a rain detector which functions to detect whether it is raining or snowing, and the output used to control another circuit. In [3] Mohammed Hadi Ismail incorporated a rain detector in his work designed to harvest rain water automatically and store same in reservoir for domestic use. Other electronic hobbyists have designed one form of rain detector/sensor in the past but the main objective of this work which is detecting rain and alerting the user was never considered.

III.SYSTEM DESIGN

The design of the system is in two sections; namely, the hardware, and the software sections. The hardware section consists of the power supply unit, and the audio output unit which functions to alert the user of the presence of rain. The software section is essentially made up of an embedded 'C' language program containing sets of instructions that are transferred into the microcontroller, the heart of the project. These instructions carryout the specific functions of sensing the minutest drop of rain water and alerting the user of the presence of rain by triggering ON the audio output (Buzzer).

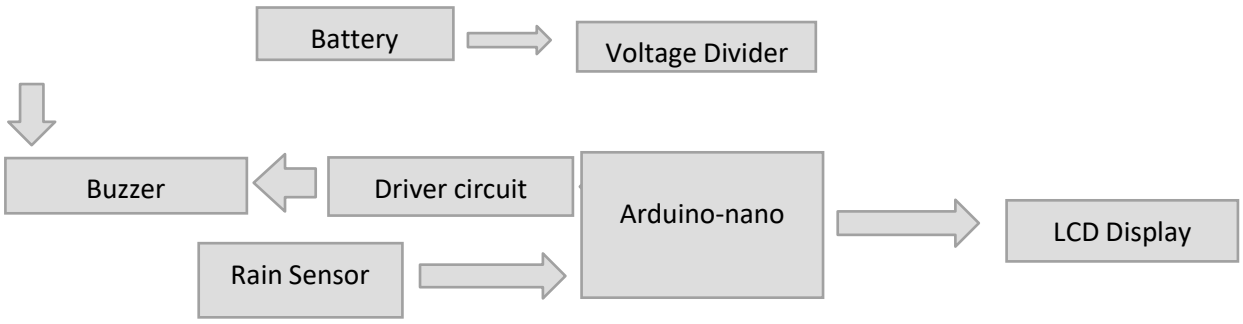


Fig : Block Diagram of Rain Detector System.

1. Power supply Unit:

The power supply unit consists of a 9V battery for powering the circuit. The 9V supply is however regulated for use with the microcontroller by regulating it to 5Vdc supply for the microcontroller using a fixed voltage regulatorLM7805.

2. Sensing Unit:

The sensor is essentially made up of a Veroboard which will receive the droplets of rain water and send signals to the microcontroller for processing. The verobaord's multiple interface which are also in close proximity with each other plays a vital role here. The board's stripes of interfaces were wired alternately such that all odd lines of stripes are linked, the even lines are also linked in same way. While the odd stripes are connected to Pin 7 of the microcontroller, the even stripes are connected to Vcc. This is so done so that whenever the veroboard receiveseven the minutest drop of rain water, both terminals are easily shorted and signal sent to the microcontroller .The microcontroller's Pin 22 which becomes high on receiving the signal drives the NPN transistor to saturation which consequently switches ON the audio output to alert user of the presence of rain. A 10k resistor is connected to thesensing unit to serve as a pulldown resistor. A pull down resistor pulls a floating node to a logic level low, i.e. it holds the logic signal near zero when no other active device is connected. (Also, a 1k resistor is connected between the base of the transistor and the microcontroller to limit the base current to a certain value)

3. Microcontroller Unit:

A microcontroller is a small and low-cost microcomputer, which is designed to perform the specific tasks of embedded systems like displaying microwave's information, receiving remote signals, etc.

The general microcontroller consists of the processor, the memory (RAM, ROM, EPROM), Serial ports, peripherals (timers, counters), etc.

4. Switching and Audio units:

The switching unit of this design is essentially an NPN, C945, and transistor. It is used for this work because the microcontroller cannot supply more than 5-10mA which is far less than what is needed to drive the output unit (Buzzer).The C945 has a typical DC current gain of 200mA at 1mA and a maximum of 0.15A.Thus,a typical basecurrent of 200mA can trigger to turn On the buzzer. The switching and audio unit is connected to the microcontroller's (AT89C52) Pin 22 through the base of the transistor.When the base voltage (Signal from the microcontroller) appears at the base of the transistor, the transistor is driven to saturation and allows current to flow in the buzzer thereby turning it ON {Buzzing to alert the user of the presence of Rain}.The Buzzer used in this work is the 9V, 4KHZ, 17MM H8MM PCB mount Piezoelectric type.

IV.RESEARCH METHODOLOGY:

1. Working of Rain Sensor:

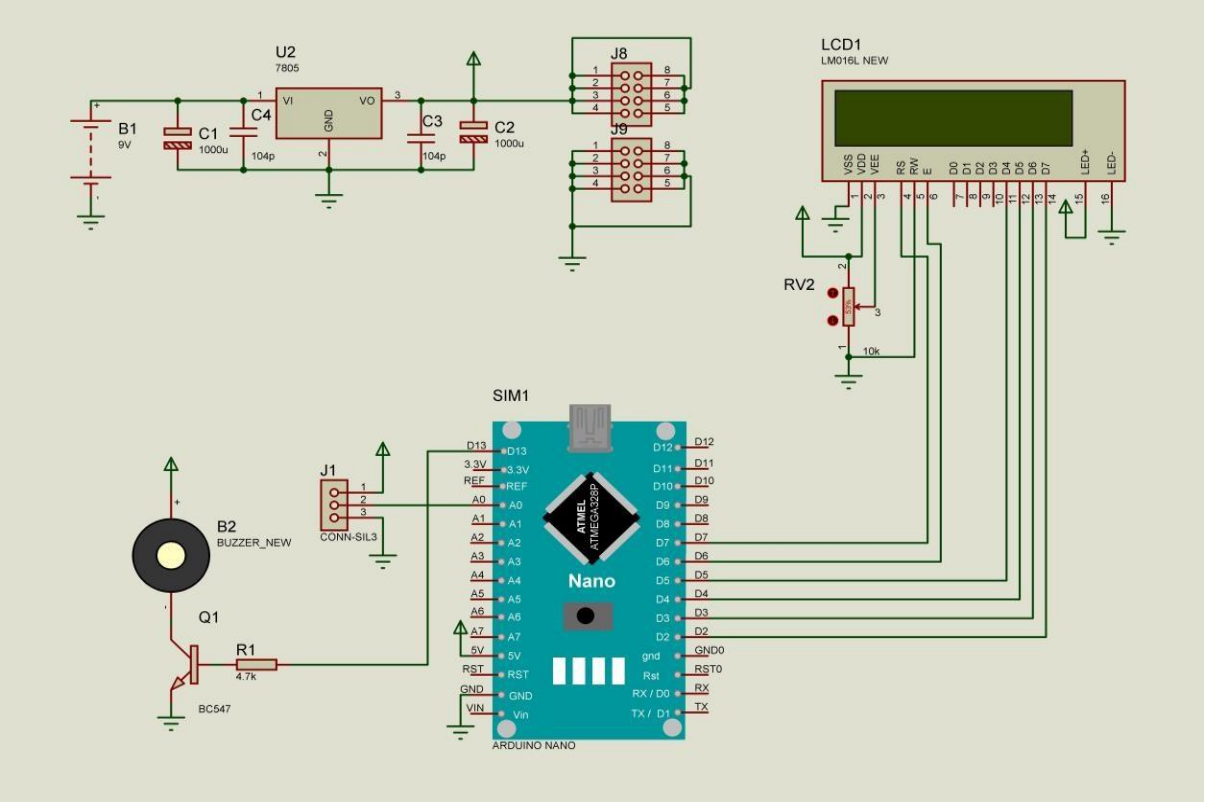
Working of the rain sensor module is simple to understand. During a sunny day, due to the dryness on the rain board module, it offers high resistance to the supply voltage. This voltage appears on the output pin of the rain board module as 5V. This 5V is read as 1023 if read by an analog pin of the Arduino. During rain, the rainwatercauses an increase in the wetness on the rain board, which in turn results in the decrease in the resistance offeredfor the supply. As the resistance decreases gradually, the output voltage starts to decrease.

When the rain board is fully wet, and the resistance offered by it is minimum, the output voltage will be as low as possible (approx. 0). This 0V is read as 0 value if read by an analog pin of the Arduino. If the rain board module is partially wet, the

output of this rain board module will be with respect to the resistance it offers. If the resistance offered by the rain board module is in such a way that the output is 3V the read analog value will be 613. Formula to find ADC can be given by, ADC = (analog voltage value X 1023)/5. By using this formula you can convert anyanalog voltage to t Arduino analog read value.

2. Circuit Diagram:

The below circuit diagram shows you the circuit connections for the Rain Drop Sensor with Arduino. The designis done using proteus, the physical modules are similar to the modules which are shown in the circuit diagram.



The rain gauge module, which is shown in the circuit diagram is connected to the control board. The control board's VCC pin is connected to the 5V supply. The ground pin is connected to ground. If needed, the D0 pin is connected to any digital pin of the Arduino, and that pin must be declared as an output pin in the program. The problem we face with the D0 pin is that we can't get the exact value of the output voltage. If the output crosses the threshold voltage, then the control module can sense the change in the output. We need to operate the buzzer, even if there is a considerable change in the output voltage in the rain board module. Due to these reasons, the A0 pin is connected to the analog pin of Arduino, which makes monitoring the change in output easy. The buzzer, which is used as a signal to the user, can be connected to any digital pin of the Arduino. If the buzzer needs morethan 5V, then try to connect a relay circuit or a transistor and then connecting the load to it.

3. Working of Arduino Based Rain Detection system:

This system works in such a way that, when there is rain, the rainwater acts as a trigger, which switches on the buzzer. In the Rain Drop Sensor Arduino Code, we defined those pins 5, and A0 are buzzer and rainfall. By doingthis, we can change the pins in the defined part of the function, and the remaining part of the code will be untouched. This will make the programmer in editing the pins easily.

In the void loop, the command reads the value from the sensor. In the next line, the command , prints the value on the serial monitor. This will be helpful while debugging. The map function maps the incoming value between0 -225. The function format for the *map* is a map (value, min value, maximum value, value to be mapped for minimum value, value to be mapped for maximum value). The buzzer will be switched ON or OFF, depending on the set value and the output of the sensor. This value is compared in the if function, with the set value. If the value is greater than the set value, it will switch on the buzzer. If the value is less than the set value, the buzzer will be switched off.

The complete working can be found in the video linked below. This is one application among the many, the sameprinciple will be seen in windshield wipers, other home automation, agriculture sectors, etc. Hope you understoodthe project and enjoyed building something useful. If you have any questions, use the comment section below oruse our forums for other technical questions.

V.CONCLUSION

The rain water detector-alarm system will be useful in both domestic and industrial applications. It alerts the user(s) of the presence of rain when it is just about to rain as even the minutest droplets of water triggers it 'ON'thereby giving the user ample time to retrieve possessions, shut windows, and in some cases prepare to harvest rain water. The device when properly placed to receive the first set of droplets of rain water can save the user from damaging possessions that were being sundried/prevent rain from entering homes, offices, and silos to mention but a few.

VI.TEST AND RESULT

The designed rain detector-alarm system was tested for a period of ten rainy days to ascertain its reliability/functionality. The testing which was done before it started to rain revealed that the audio unit of the system was triggered ON even when the droplets of rain have not become visible to the human eyes, thus showing clearly that the system could detect the thinnest or minutest droplets of rain and alert the user accordingly, whichis in agreement with the design objective.

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