Apricitas Umbrella

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***Abstract* —** *In this project, we looked at how to use rain as a means of interaction to light up your rainy days.We will add some light to rainy days by adding LEDs into an ordinary umbrella where more rain will add more light. In the remote places and villages the most common problem faced is the electricity. And this becomes worst in the rainy days or during heavy rain fall. Most of the time person will suffer to identify the path during heavy rains due to lack of street light. To avoid this situation we came with this idea of Apricitas Umbrella.*

I. INTRODUCTION

The word “Apricitas” is Latin word which means “Sunshine”. Even we can call this as sunshine umbrella as it provides light when where the rain sensor board detects water. Rain water sensor plays the major role. It is mainly used in the night time during rainfall.

II. COMPONENTS

The components that we have used in this project are listed below:

1. Arduino Pro mini Board
2. Rain water sensor module
3. Lily Pad LEDs
4. Conductive thread
5. Umbrella
6. Soldering gun
7. 9V battery

Arduino Pro Mini : The Arduino Pro Mini is an ATmega168 based microcontroller board. The board comes with built-in arduino bootloader. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, an on-board resonator, a reset button, and holes for mounting pin

headers. The board can be connected to the PC using USB port and the board can runs on USB power. There are two version of the Pro Mini. One runs at 3.3V and 8 MHz, the other at 5V and 16 MHz In this we have used 5V and 16MHz microcontroller. The Arduino Pro Mini is intended for semi-permanent installation in objects or exhibitions. The board comes without pre-mounted headers, allowing the use of various types of connectors or direct soldering of wires. The pin layout is compatible with the Arduino Mini.

a. Power

The Arduino Pro Mini can be powered with an FTDI cable or breakout board connected to its six pin header, or with a regulated 3.3V or 5V supply (depending on the model) on the Vcc pin. There is a voltage regulator on board so it can accept voltage up to 12VDC. If you're supplying unregulated power to the board, be sure to connect to the "RAW" pin on not VCC.

The power pins are as follows:

i. RAW : For supplying a raw voltage to the board.
ii. VCC : The regulated 3.3 or 5 volt supply.
iii. GND : Ground pins.

fig : 1

b. Input and Output

Each of the 14 digital pins on the Pro Mini can be used as an input or output, using pinMode, digitalWrite, and digitalRead functions. They operate at 3.3 or 5 volts (depending on the model). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50k. In addition, some pins have specialized functions:

- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bitPWM output with the analogWrite function.

- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the TX-0 and RX-1 pins of the six pin header
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

The Pro Mini has 8 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). Four of them are on the headers on the edge of the board; two (inputs 4 and 5) on holes in the interior of the board. The analog inputs measure from ground to VCC. Additionally, some pins have specialized functionality:

- I2C: A4 (SDA) and A5 (SCL). Support I2C (TWI) communication using the Wire library.

There is another pin on the board:

- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Rain Water Sensor Module: The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer.

The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

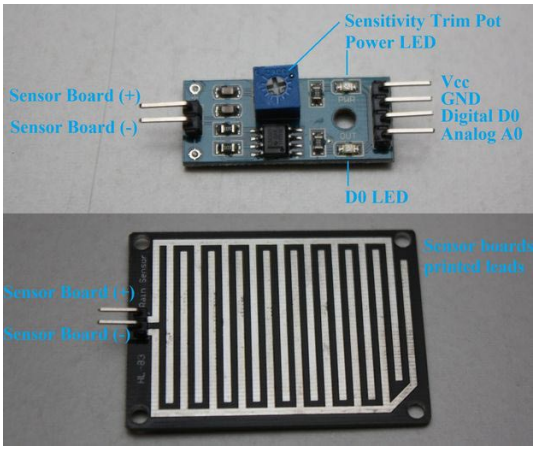

fig: 2

Pins:
A0-Analog output
D0-Digital output
GND- Ground
VCC- Positive voltage (input: 5v for analog 3.3v for Digital.)
Loop Pins:
+ : Sensor board hook-up A
- : Sensor board hook-up B

Lily Pad LEDs : The Lily Pad system is a set of sewable electronic pieces designed to help you build soft, sewable, interactive e-textile projects. Each Lily Pad piece has large conductive sew tabs for easy sewing and a rounded shape so as not to snag fabric or cut thread.

fig : 3

Conductive Threads: Conductive thread can carry current the same way that wires can, which means it can be used to create a circuit. This allows the user to sew a circuit together, creating flexible circuits that require no soldering. In some textile-based projects, this is the most practical tool to maintain the hang of the fabric. Educationally, it's a very safe and unintimidating way to learn how to use embedded electronics.

Beyond our selection of conductive threads, there exists a staggering number of conductive materials. If it's electrically conductive (you can check this with a multimeter), and you can sew with it (this includes hand and machine, sewing and embroidery, crocheting, knitting, all sorts of things, really. Some traditional embroidery threads have enough metal content to be conductive, and some wires are fine enough to sew with.

fig: 4

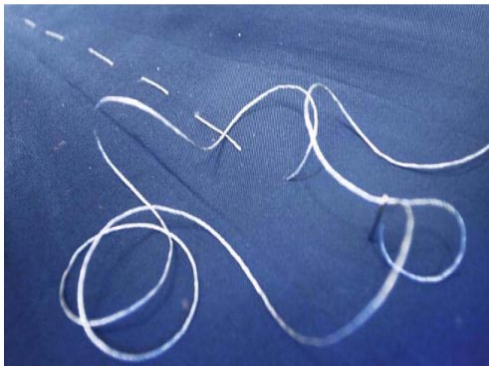

fig:5

Soldering Gun: A soldering gun is an approximately pistol-shaped, electrically powered tool for soldering metals using tin-based solder to achieve a strong mechanical bond with good electrical contact. The tool has a trigger-style switch so it can be easily operated with one hand. The body of the tool contains a transformer with a primary winding connected to mains electricity when the trigger is pressed, and a single-turn secondary winding of thick copper with very low resistance. A soldering tip, made of a loop of thinner copper wire, is secured to the end of the transformer secondary by screws, completing the secondary circuit. When the primary of the transformer is energized, several hundred amperes of current flow through the secondary and very rapidly heat the copper tip. Since the tip has a much higher resistance than the rest of the tubular copper winding, the tip gets very hot while the remainder of the secondary warms much less. A tap on the primary winding is often used to light a pilot lamp which also lights the work piece.

The soldering gun is useful when soldered joints must be made intermittently. A constant-heat device has to be set in a safe place when powered but not actually in use, to prevent damage or injury. The fast-switching gun cools quickly enough to be set down a few seconds after use.

fig: 6

III. CONSTRUCTION

We used a conductive thread stitched into the umbrella for the water sensing (fig: 5), two lines stitched in parallel along the top and down on the umbrella. The lines should be close, but not so close that they touch. The lines do not need to be straight; instead, you can be a bit creative and make a nice pattern using the conductive thread.

To be sure that to catch as much rain as possible, have two sensors on opposite sides of the umbrella to make the interaction a bit nicer. After stitching all the conductive thread lines on the top of the umbrella, it's time to add the cables for the power and ground to the inside of the umbrella, as shown in the figure.

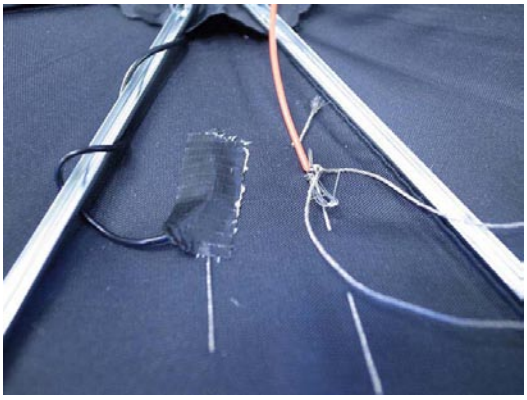

fig: 7

The reason for adding normal wires to the conductive thread on the inside of the umbrella is that umbrellas are usually constructed of metal, and we don't want any short circuits since the conductive thread is basically an open wire. There would certainly be a danger of that if we trailed bare thread around the inside of the umbrella. To attach the wires to the thread, make a loop of the stripped part of the wire and make knots through it and around it using conductive thread. Then use a duct tape to cover up and hold the connections in place.

Really make sure that the knots are tight so that you have a good connection between your conductive thread and wires. The length of the wires depends on where you will place the Arduino later on, but I suggest measuring the pole of the umbrella and adding a bit more to be generous. It's better to have a wire that is too long, which you can cut, than one that is too short and needs to be extended.

While soldering the LEDs, solder all the ground connections together. Start by soldering together the ground connections of five LEDs for each of the four straight lines. The easiest is to take one LED at a time and solder a wire to the bottom of the leg, and then solder the other wire to the top of the leg, as shown in Figure 8. The length of the wire between the LEDs depends on the amount of space you want between them. You need to measure your umbrella to be certain.

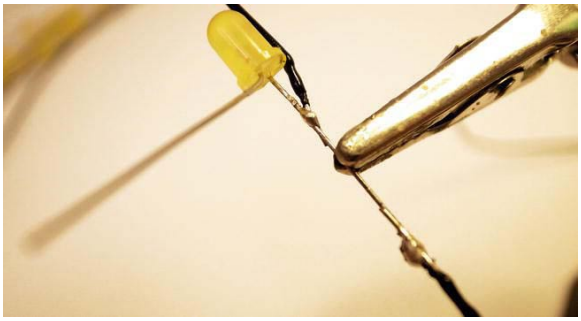

fig: 8

Just make sure that the leg is insulated so it does not come in contact with the metal. To be on the safe side, add electrical tape to the metal rod. To hold the wire in place, cover it with more electrical tape around the arm. Figure 9 shows an LED in the groove of the umbrella's arm.

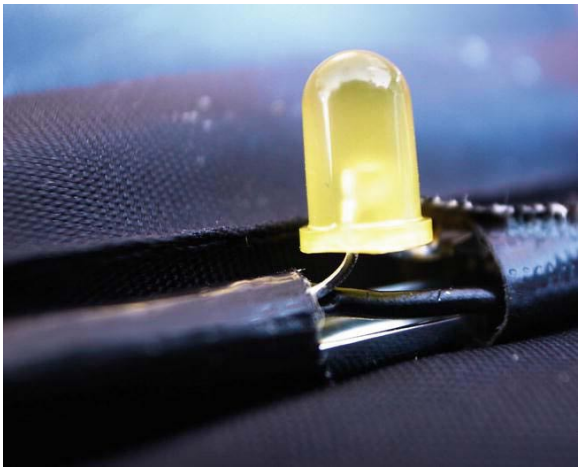

fig: 9

Now add all the LEDs to one another in such a way that they form a closed loop and all are connected in parallel to each other, i.e all the positives are connected together and same for the negatives.

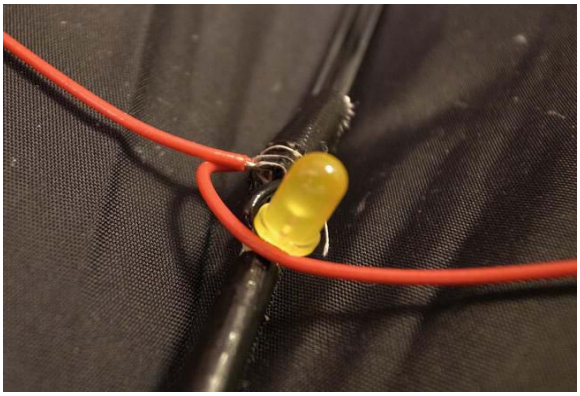

fig: 10

Once done with the soldering ,we will have something looking like in figure 11 where left over positive and negative terminal ends are going to the pole of the umbrella, waiting to be connected to the Arduino board.

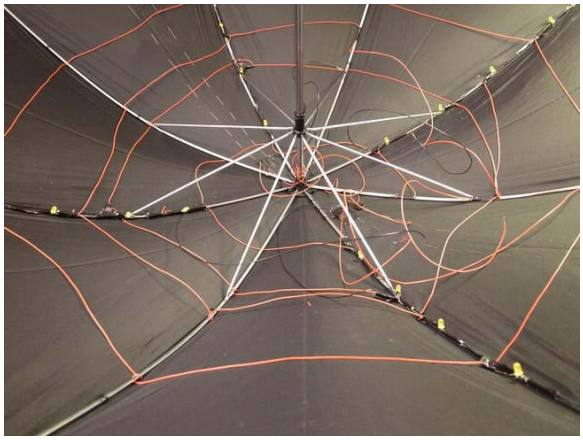

fig: 11

You will need to add 220 ohm resistors to the power wires, as well as two 10 kilohm resistors for the water sensor. Connect the power supply to the Arduino Pro Mini Board using the USB cable or the FDTI cable in order the dump the arduino code into the Arduino Pro Mini to work according to our requirements. The code that we have used has a predefined ranges of inputs. According to the variations of the intensity of the rain fall, the case that has to be executed will change, as the intensity of LEDs would change accordingly.

Once the code is uploaded into the microcontroller(Arduino board) we can check the out in the serial pointer or look at the onboard LED to check if the proper connection is made in the water. After getting the desired output use a 9V battery as the Vcc supply instead of the cable. The overall circuit would be looking as shown in the figure 12.

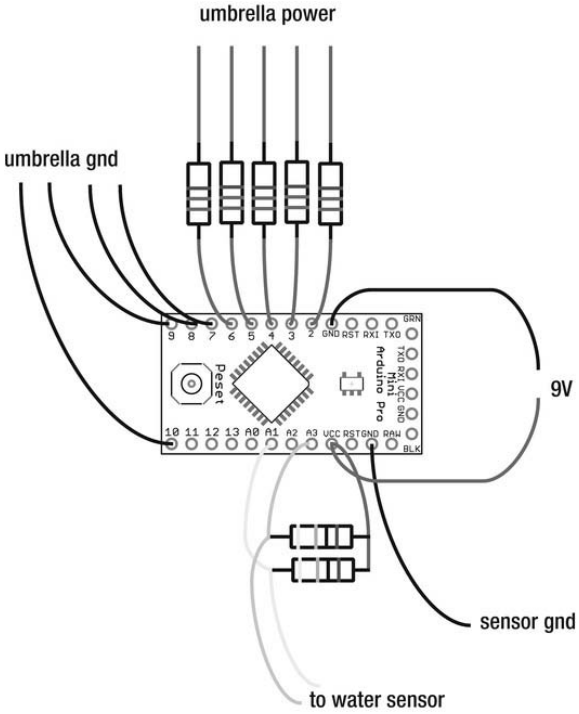

fig: 12

IV. WORKING

Rain water sensor plays the major role. The rain sensor module is used to detect the amount of water present on the sensor and with a controller. This module allows you measure moisture via analog output pins and it provides a digital output when a threshold of moisture is exceeded. The module is based on the LM393 op amp.

It includes the electronics module and a printed circuit board that “collects” the rain drops. As rain drops are collected on the circuit board, they create paths of parallel resistance that are measured via the op amp.

The lower the resistance (or the more water), the lower the voltage output. Conversely, the less water, the greater the output voltage on the analog pin. A completely dry board for example will cause the

module to output five volts. Here, the analog output (AO) of the rain sensor module is linked to one analog input (A0) of the Arduino, so that the microcontroller can read an analog voltage between 0 and 5 volts to process a number between 0 and 1023, where 0 representing 0 volt, and 1023 representing 5 volt. During rain, the sensor plate elements are bridged by the rain water and hence this analog output gradually changes from 5V to 0V, based on the moisture level between the sensor pads. By this way, the sensor reports the absence and presence of the rain in an analog way, help us to determine whether the rain is light or strong by analyzing the outputted analog signal. The approximation is handled by a simple Arduino program within a pre-defined range of intervals.

The program dumped in the Arduino pro mini board does a couple of things:

- It monitors the digital output from the module and makes the decision that it is raining if the digital output goes low.
- It measures the analog output and provides a moisture level, where 1023 is high and where 0 is very wet.

As rain drops are collected on the circuit board, they create paths for the parallel combination of LEDs connected to the umbrella, this makes LEDs glow.

Fig:13

V. CONCLUSION

In this project, we looked at how to use rain as a means of interaction to light up rainy days especially at night times. A major constraint with developing and maintaining rural roads is the fact that they are unfortunately rural. The major problem even the urban or well developed areas facing is about manhole, these are kept open on roads even after completion of maintenance works. So, we can avoid these manholes by using this umbrella. The light from the umbrella also helps us to navigate through our path. While umbrellas are a helpful accessory to carry around, during the night time it can be hard for cars to see someone that is hidden behind a big, black umbrella. This umbrella eliminates this issue entirely with the help of light emitted from light emitting diode stitched to it. It makes easy for vehicles to detect a person passing by the road. When there is hardly any natural light out, the materials used in the umbrella picks up the light. This umbrella not only protects us from rain, but will help to keep you safe if you're walking through night time rainfall. Much like a bike glow strip, these umbrellas stylishly provide safety and shelter from the rain.

VI. REFERENCES

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