

DESIGN AND IMPLEMENTATION OF CLOUD BASED LIGHT INTENSITY MONITORING & CONTROL SYSTEM USING RASPBERRY PI

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ABSTRACT

There are assortment of uses for Light Meters for measuring and keeping up sufficient light levels, for example, research facilities, healing centers, schools and so forth. To keep up more advantageous and more secure condition sufficient light levels in the working environment are important. Also during summer days, light intensity coming from sun light is too high which has to be controlled for avoiding overheating. These outcomes in keeping up light power. Light force estimation should be possible utilizing distinctive sensors. Generally favoured sensors are LDR and photo diode. In the greater part of the applications estimation of light force is important to keep up required measure of light.

KEYWORDS: Raspberry pi B+ model, HDMI cable, LDR circuit, GPIO

INTRODUCTION

A considerable lot of the enterprises are troubled with predetermined number of assets and genuine deficiency of specialists on their fields; real time remote checking presents a successful arrangement that limits their endeavours and consumptions to accomplish the craved outcomes inside time. This paper presents constant remote Light force observing framework utilizing Raspberry Pi which empowers the client to track the lighting framework remotely. Raspberry pi is a minimal effort ARM controlled Linux based PC which goes about as a server, and it speaks with customers with LAN or outside Wi-Fi module. The key element of this framework is light power being observed promptly and information put away in the database for sometime later, and appeared as dynamic diagrams to the client as per the client necessity in a terminal gadget like Tablet or Smart Phone or any web empowered gadget.

This enables specialists to settle on right choices at opportune time to get sought outcomes

To guarantee wellbeing out and about, movement lights should be plainly obvious for street clients. The light force must be adequate under each (climate) condition, which set in legitimate principles. Throughout time, the iridescent force of activity lights gradually diminishes. Conceivable reasons are contamination of focal points or reflectors, maturing of the light source or individual LED failure. Remote observing empowers the street specialist to do opportune administrations, in a manner that activity lights keep satisfying the statutory guidelines for ideal movement wellbeing.

HARDWARE DEVELOPMENT

The hardware architecture as shown in Fig. has following components Analog to Digital converter, Light Dependent Resistor, Signal conditioning circuit and Raspberry Pi.

BLOCK DIAGRAM

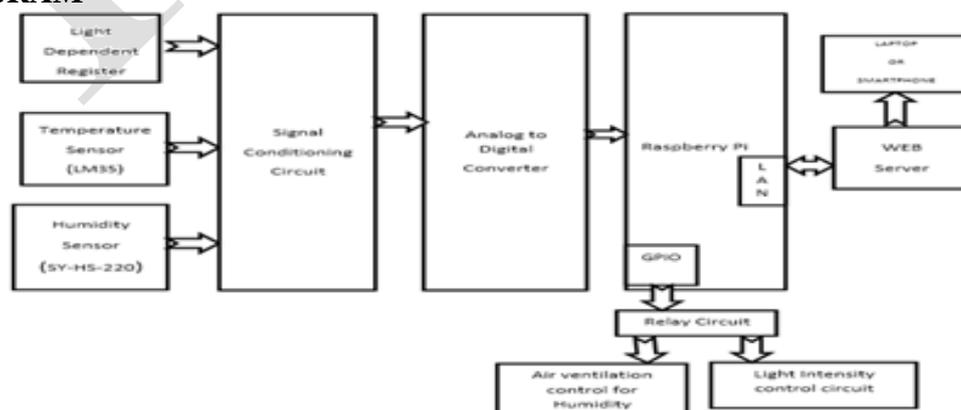


Figure 1: Block Diagram of system

RASPBERRY PI

Raspberry Pi (appeared in Fig 2) is a MasterCard measured ARM controlled Linux PC created in the UK by Raspberry Pi establishment with the expectation of fortifying the educating of fundamental software engineering in schools. It has five models; Model A has 256Mb RAM, one USB port and no network connection. Model A+ has conclusions in a general sense the same as Model A, however replaces the 26-stick GPIO connector, by a 40-stick connector, a little scale SD space replaces a full-sized SD opening, and power organization has been upgraded so that it's more gainful, and can reinforce "control hungry" USB gadgets. [2] Model B+ has particulars fundamentally the same as Model B, yet replaces the 26-stick GPIO connector, by a 40-stick connector, a smaller scale SD space replaces a full-sized SD slot, replaces the 2 USB ports, by 4 USB ports and power administration has been enhanced so that it's more effective. [8-9] The chip especially gives little scale HDMI and 3.5mm A V jack. As generally pushed Raspberry pi2 has vague board Layout and impression as the Model B+ anyway It has Quad processor continues running at 900MHz and RAM of 1GB.

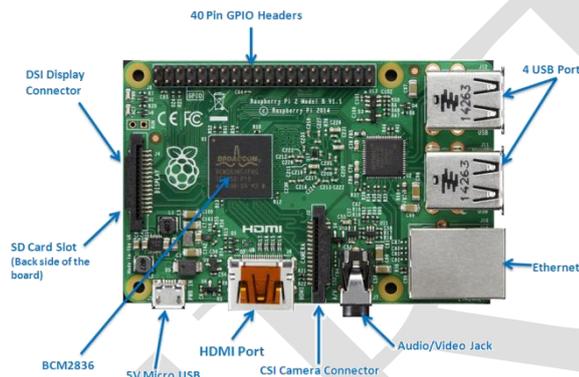


Figure 2. Raspberry Pi B+ model Diagram

2.2 SENSORS

2.2.1 LIGHT SENSOR

A LDR (Light Dependent Resistor) is variable resistor, the resistance of the LDR is conversely relative to the light power, it displays most extreme resistance without light and least resistance within the sight of light.

Commonly a hand-off is utilized - especially when the low voltage light recognizing circuit is utilized to switch on (or off) a 240V mains fueled gadget. A graph of that piece of the circuit is appeared previously. At the point when haziness falls (if the LDR circuit is designed that path around), the transfer is activated and the 240V gadget - for instance a security light - switches on.

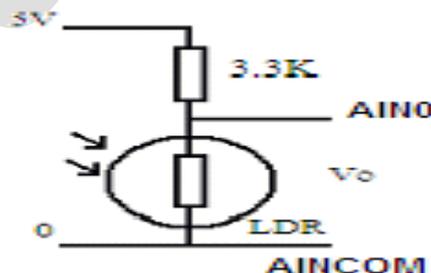
2.2.1.1 MEASURE LIGHT INTENSITY USING LIGHT DEPENDENT RESISTOR (LDR):

The relationship between the resistance R_L and light intensity Lux for a typical LDR is

$$R_L = 500 / \text{Lux Kohm}$$

With the LDR connected to 5V through a 3.3K resistor, the output voltage of the LDR is

$$V_o = 5 * R_L / (R_L + 3.3)$$



Reworking the equation, we obtain the light intensity $\text{Lux} = (2500/V_o - 500)/3$

2.2.2 HUMIDITY SENSORS

A humidity sensor senses relative humidity. This implies it gauges both air temperature and dampness. Relative stickiness, communicated as a percent, is the proportion of real dampness noticeable all around to the most astounding measure of dampness air at that temperature can hold. The hotter the air is, the more

dampness it can hold, so relative moistness changes with variances in temperature.

The most common type of humidity sensor uses what is called “capacitive measurement.” This framework depends on electrical capacitance, or the capacity of two adjacent electrical channels to make an electrical field between them. The sensor itself is made out of two metal plates with a non-conductive polymer film between them. The film gathers dampness from the air, and the dampness causes minute changes in the voltage between the two plates. The adjustments in voltage are changed over into computerized readings demonstrating the measure of dampness noticeable all around.

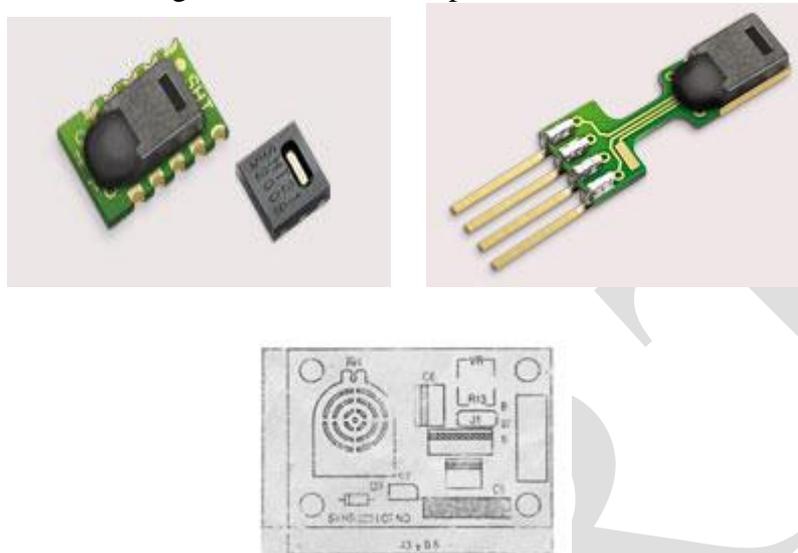


Fig.2.5.2.1 LM 35 sensor & its schematic diagram

PARAMETERS	SPECIFICATIONS
RATED VOLTAGE	DC 5.0V
CURRENT CONSUMPTION	<3.0mA
OPERATING TEMPERATURE RANGE	0-60°C
OPERATING HUMIDITY RANGE	30-90%RH
STORABLE TEMPERATURE RANGE	-30°C~85°C
STORABLE HUMIDITY RANGE	within 95%RH
STANDARD OUTPUT RANGE	DC1.980mV (at25°C, 60%RH)
ACCURACY	±5%RH (at 25°C, 60%RH)
REMARKS	PCB unit containing driving circuit

2.2.3 TEMPERATURE SENSOR (LM35)

The LM35 sensor courses of action are precision joined circuit temperature sensors, Whose yield voltage is specifically with respect to the Celsius (Centigrade) temperature.



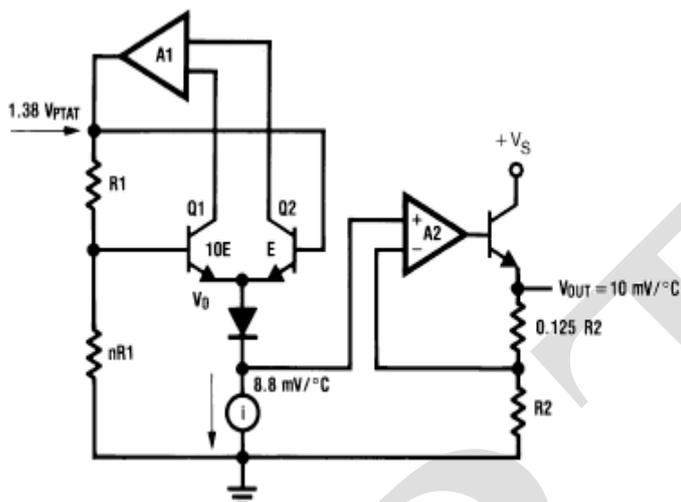
Fig.2.5.3.1 LM35 Sensor

The LM35 sensor does not require any outside change or trimming to give typical exactnesses of $\pm 1/4^\circ\text{C}$ at room temperature and $\pm 3/4^\circ\text{C}$ over a full - 55 to $+150^\circ\text{C}$ temperature increment. Inconsequential effort is guaranteed by trimming and change at the wafer level.

As it draws just 60 μA from its supply, it has low self-warming, under 0.1°C in still air. The LM35 is assessed to work over a - 55° to $+150^\circ\text{C}$ temperature go, while the LM35C sensor is evaluated for a - 40° to $+110^\circ\text{C}$ domain (- 10° with improved precision). The LM35 plan is available packaged in hermetic TO-46

transistor social events, while the LM35C, LM35CA, and LM35D are in addition open in the plastic TO-92 transistor package. The LM35D sensor is moreover open in a 8-lead surface mount little arrangement bundle and a plastic TO-220 bundle.

2.2.3.1 LM35 SENSOR CIRCUIT SCHEMATIC



2.5.3.1 LM35 Sensor Pinouts and Packaging

As it draws just 60 μ A from its supply, it has low self-warming, under 0.1°C in still air. The LM35 is evaluated to work over a - 55° to +150°C temperature run, while the LM35C sensor is appraised for a - 40° to +110°C territory (- 10° with enhanced precision). The LM35 arrangement is accessible bundled in hermetic TO-46 transistor bundles, while the LM35C, LM35CA, and LM35D are likewise accessible in the plastic TO-92 transistor bundle.

2.3 SIGNAL CONDITIONING CIRCUIT

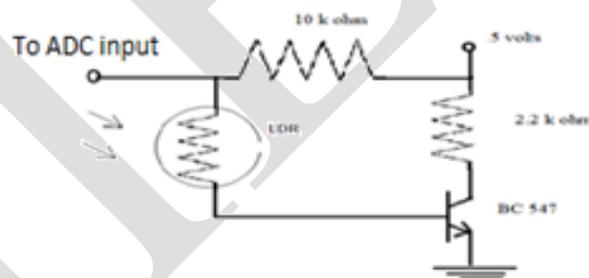


Figure 1. Signal conditioning circuit

SIGNAL CONDITIONING CIRCUIT SPECIFICATION:

Table 1. Component used in circuit

Component	Specifications
LDR	GL 35 series
Resistor	10 k ohm
Resistor	2.2 k ohm
Transistor	BC 547

The signal conditioning circuit block diagram as shown in figure 3. Depending on the sensor output the parameter of signal conditioning circuit change. The output of this circuit is sufficiently calibrated to be fed to ADC circuit.

2.4 ANALOG TO DIGITAL CONVERTER

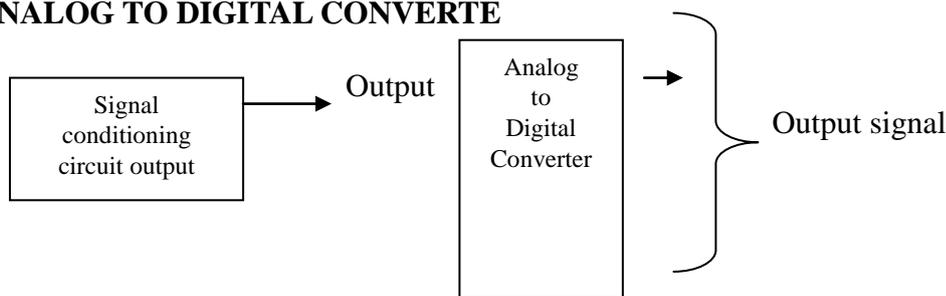


Figure.4. Block diagram of Analog to Digital Converter

ADC IC 3208 SPECIFICATION

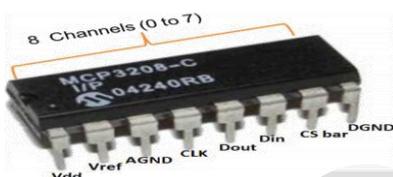


Figure 5 MCP3208 Analog to Digital converter.

Table no. 2. PIN function table

Name	Function
VDD	+2.7V to 5.5V Power Supply
DGND	Digital Ground
AGND	Analog Ground
CH0-CH7	Analog Inputs
CLK	Serial Clock
DIN	Serial Data In
DOUT	Serial Data Out
CS/SHDN	Chip Select/Shutdown Input
VREF	Reference Voltage Input

It is a 12 bit 8 channel Analog to Digital converter. It utilizes the SPI transport convention which is upheld by the pi's GPIO header.

We have to empower the SPI interface on the raspberry pi by altering the design record i.e., raspi-blacklist.conf the accompanying summon is utilized to open the arrangement document `sudo nano letcimodeprobe.Draspi-boycott.conj` Add a "#" character before the line `spi-bcm2708`. Use CTRL-X, then Y, then Return to save the record and exit. Reboot utilizing taking after order `sudo reboot`. With a specific end goal to peruse information from the SPI transport in Python we can introduce a library called 'pyspidev'. Know prepared to utilize SPI convention in raspberry pi. Plan the ADC input registers to pick particular redirect in the ADC and use bitwise directors to get wanted yield from the yield registers.

2.5 RELAY CIRCUIT

A relay is an electrically operated switch. Many trades utilize an electromagnet to mechanically work a switch, yet other working standards are additionally utilized, for example, strong state trades. Trades are utilized where it is basic to control a circuit by another low-control flag, or where two or three circuits must be controlled by one pennant.

2.5.1 NRP 07 RELAY



Fig.2.6.1 nrp 07 relay

A sort of transfer that can deal with the high power required to specifically control an electric engine or different burdens is known as a contractor. Strong state transfers control circuits with no moving parts, rather utilizing a semiconductor gadget to perform exchanging.

SPECIFICATION

Arrangement	1A/1B/1C
Contact Material	Silver Alloy
Contact Resistive	Max.: 100 mΩ
Rating	12A 120VAC
Resistive load (cosφ=1)	10A 28VDC
Max. Switching Voltage	250VAC / 30VDC
Max. Switching Power	1250VA / 280W
Expected life	
Mechanical	1×10 ⁷

2.5.2 IC ULN2003A

The ULN2003A is an array of seven NPN Darlington transistors capable of 500 mA, 50 V output. It highlights regular cathode fly back diodes for exchanging inductive burdens. It can come in PDIP, SOIC, SOP or TSSOP bundling. In a similar family are ULN2002A, ULN2004A, and in addition ULQ2003A and ULQ2004A, intended for various rationales input levels. The ULN2003 is known for its high-present, high-voltage limit. The drivers can be paralleled for much higher momentum yield. Considerably further, stacking one chip on top of another, both electrically and physically, has been finished. By and large it can likewise be utilized for interfacing with a stepper engine, where the engine requires high evaluations which can't be given by other interfacing gadgets.

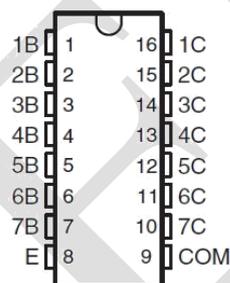


Fig.2.7.2 ULN2003A pinout

MAIN SPECIFICATIONS

- 500 mA rated collector current (single output)
- 50 V output (there is a version that supports 100 V output)
- Includes output fly back diodes
- Inputs compatible with TTL and 5-V CMOS logic

2.5.3 STEPPER MOTOR

A stepper motor or step motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

WORKING

In this circuit we use stepper motor for control the brightness of light. It will change the brightness of light as per change in light intensity measured by LDR sensor. It means it will change voltage supply of light and control its brightness.

Suppose if LDR sensor detects low light intensity then this data will get by raspberry pi and it will commands to stepper motor that it will increase the brightness of light. Same if LDR sensor detects high light intensity then this data will get by raspberry pi and it will commands to stepper motor that it will decrease the brightness of light.

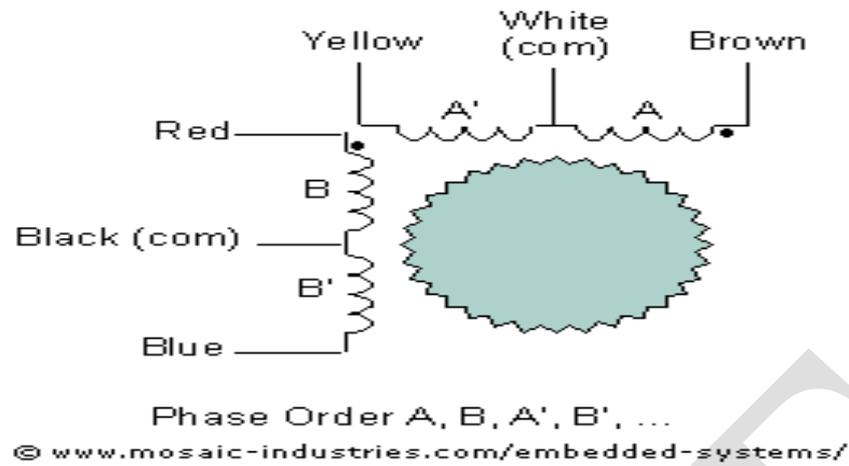


Figure 2.9.1 Stepper motor winding diagram

2.6 INTERFACING CONNECTORS GPIO

- General-purpose input/output (GPIO) is a non-specific stick on an integrated circuit whose conduct, including whether it is an input or output stick, can be controlled by the client at run time.
- GPIO pins can be designed to be input or output.
- GPIO pins can be enabled/ disabled.
- Input qualities are decipherable (commonly high=1, low=0).
- Output qualities are writable/ readable.
- Input qualities can regularly be utilized as IRQs (normally for wakeup occasions).
- GPIO voltage levels are 3.3 V and are not 5 V tolerant.

HDMI CABLE

A HDMI or composite video-fit TV or screen.

A HDMI-able screen since it offers better determination and inherent sound. You can utilize simple in the event that you need, be that as it may. A HDMI link to interface Raspberry Pi to screen.

2.7 HTML

HTML markup consists of several key components, including those called tags (and their attributes), character-based data types, character references and entity references. HTML tags most commonly come in pairs like `<h1>` and `</h1>`, although some represent empty elements and so are unpaired, for example ``. The first tag in such a pair is the start tag, and the second is the end tag (they are also called opening tags and closing tags).

Another important component is the HTML document type declaration, which triggers standards mode rendering.

The following is an example of the classic Hello world program, a common test employed for comparing programming languages, scripting languages and markup languages. This example is made using 9 lines of code:

```
<!DOCTYPE html>
<html>
  <head>
    <title>This is a title</title>
  </head>
  <body>
    <p>Hello world!</p>
  </body>
</html>
```

(The text between <html> and </html> describes the web page, and the text between <body> and </body> is the visible page content. The markup text "<title>This is a title</title>" defines the browser page title.)

PROCEDURE

1. Connect ADC circuit to LDR, Humidity & Temperature sensor circuit and raspberry pi using cables.
2. Also connect Relay circuit to Raspberry pi and light, fan and sprinkler circuit.
3. Connect Raspberry pi to screen utilizing HDMI link.
4. Plug the power cable to raspberry pi to turn on device.
5. Subsequent to turning on raspberry pi the working framework will begin booting and it will appear on screen.
6. After complete the booting of raspberry pi we will get the initial desktop screen of Raspberry pi.
7. Open command window.
8. Type in command window ‘sudo su’
9. Open drive where you store the program file. Using ‘cd’ command.
10. After opening drive write ‘python file name.py’ because the program should be done in python language we get ‘.py’ extension for program file. Therefore run this file we first write python.
11. Then you’ll see the readings which are from sensors. You can see the progressions of readings according to change.
12. For stop program execution press ctrl + z. The execution of program will stop.

RESULTS

As per the methodology 3 sensors used for various parameters. Three sensors are as Temp. (LM35), Humidity & Light (LDR). We can see the result as follow

TEMPERATURE SENSOR

```

*****
Temperature(C) | Light(Lux) | Humidity(%)
*****
40             | 0150       | 0200
-----
    
```

Fig.1 Normal temperature reading

The normal temperature range is approximately average set value is 40°C. But if temperature start to increase and reached above 40°C as shown in below fig.2

```

*****
Temperature(C) | Light(Lux) | Humidity(%)
*****
41             | 0150       | 0200 |
-----
*****
Temperature(C) | Light(Lux) | Humidity(%)
*****
45             | 0150       | 0200 |
-----
    
```

Fig.2 Temperature starts increasing

Then the temperature Sensor starts to collect data and forward It to raspberry pi . After Raspberry pi get the data it will compare the value collected values with average set value.

Then if observes that collected values are grater than the average set value it will turn on the fan with the help of relay switch.

Fan will continuos turn on until the raspberry get the less or equal value of average set value. As per below fig.3 Temperature decreases to normal

```

*****
Temperature(C) | Light(Lux) | Humidity(%)
*****
40             | 0150       | 0200
-----
    
```

Fig. 3 Temperature decreases to normal

After that it turn off the fan.

LIGHT INTENSITY

```
*****
Temperature(c) | Light(Lux) | Humidity(%)
*****
40             |    0150     |    0200
-----
```

Fig.1 Normal Light Intensity reading

The normal light Intensity range is approximately average set value is 150 lux. But if light Intensity start to increase and reached above 150 lux as shown in below fig. 2

```
*****
Temperature(c) | Light(Lux) | Humidity(%)
*****
40             |    0166     |    0200
-----

*****
Temperature(c) | Light(Lux) | Humidity(%)
*****
40             |    0167     |    0200
-----
```

Fig. 2 light Intensity starts increasing

Then the LDR Sensor starts to collect data and forward It to raspberry pi . After Raspberry pi get the data it will compare the value collected values with average set value.

Then if observes that collected values are grater than the average set value it will turn on the light with the help of relay switch.

Light will continuos turn on until the raspberry get the less or equal value of average set value. As per below fig.3 light Intensity decreses to normal

```
*****
Temperature(c) | Light(Lux) | Humidity(%)
*****
40             |    0150     |    0200
-----
```

Fig.3 light Intensity decreses to normal

After that it turn off the light.

HUMIDITY SENSOR

```
*****
Temperature(c) | Light(Lux) | Humidity(%)
*****
40             |    0150     |    0200
-----
```

Fig. 1 Normal Humidity reading

The normal Humidity range is approximately average set value is 200 %. But if Humidity start to increase and reached above 200 % as shown in below fig. 5.3.1

```
*****
Temperature(c) | Light(Lux) | Humidity(%)
*****
40             |    0150     |    0217
-----

*****
Temperature(c) | Light(Lux) | Humidity(%)
*****
40             |    0150     |    0222
-----
```

Fig. 2 Humidity starts increasing

Then the Humidity Sensor starts to collect data and forward It to raspberry pi . After Raspberry pi get the data it will compare the value collected values with average set value.

Then if observes that collected values are grater than the average set value it will turn on the sprinkler with the help of relay switch.

Sprinkler will continuos turn on until the raspberry get the less or equal value of average set value. As per below fig.3 Humidity decreases to normal

```

*****
Temperature(C) | Light(Lux) | Humidity(%)
*****
40             |    0150    |    0200
-----
    
```

fig.3 Humidity decreases to normal

After that it turn off the Sprinkler.

Also we can observe the changes at same time by using camera that helps us to get live streaming video of that situation.

CONCLUSION

In the paper, we have proposed and created cloud based light power checking framework. This helps to user to take necessary action at right time, with proper controlling with can achieve desired results. To assess the framework, we have considered poultry cultivate for instance however it can be utilized at different applications like activity light checking, exhibition hall lighting and so on to evade harms.

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