IOT BASED LIGHT INTENSITY MONITORING SYSTEM USING EMBEDDED LINUX & RASPBERRY PI

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ABSTRACT:
Accurate and quantifiable measurement of light is essential in creating desired outcomes in practical day to day applications as well as unique applications such as Traffic lighting system, Poultry Industry, Gardening, Museum lighting system, at emergency exits etc. Hence, Light measurement and analysis is an important step in ensuring efficiency and safety. Many of the industries are burdened with limited number of resources and real shortage of experts on their fields; real time remote monitoring presents an effective solution that minimizes their efforts and expenditures to achieve the desired results within time. This paper introduces real time remote Light intensity monitoring system using Raspberry Pi which enables the user to track the lighting system remotely. Raspberry pi is a low cost ARM11 processor Linux based computer which acts as a server, and it communicates with clients with LAN or external Wi-Fi module. The key feature of this system is light intensity being monitored instantaneously and data stored in the database for future use, and shown in the form of dynamic charts to the user according to the user requirement in a terminal device like Tablet or Smart Phone or any internet enabled device. This empowers experts to make right decisions at right time to get desired results.
Keywords: LDR. Light Intensity, Temperature, Smoke, Raspberry Pi, Web Server, Camera, Buzzer.

I.INTRODUCTION

There are many applications available to measuring and maintain the sufficient light levels such as laboratories, hospitals, educational institute, etc. To sustain healthier and safety environment enough light levels in the premises are needed. Without any distraction of whether condition, the light intensity has to be adequate for light levels intensity Some of important locations and light intensity is shown in TableI.

TABLE I. Optimum Average Light Intensity at Various Locations. Consider following Applications as an Example

Location	Illuminance(LUX)
Homes, Theaters	150
Library(Reading Area)	200
General Office work	500
Class room	300

A. Traffic Lighting System:-To ensure safety on the road, traffic lights need to be clearly visible for road users. The light intensity has to be sufficient under every (weather) condition, which set in legal standards. Over the course of time, the luminous intensity of traffic lights slowly decreases. Possible reasons are pollution of lenses or reflectors, aging of the light source or individual LED failure. Remote monitoring enables the road authority to carry out timely services, in such a way that traffic lights keep satisfying the statutory rules for optimal traffic safety.

B. Poultry Industry:-Light Intensity is an important management factor in poultry industry to obtain optimal production. The intensity depends upon the age and type of housing being used, and type of chicken, be it broiler, breeder or layer. With blackout housing both male and female can be exposed to 3.5 fc from day one to day six and then placed on 1 fc to 19 or 20 weeks. After 19 - 20 weeks the broiler breeders can be exposed to about 3.0 to 5.0 fc during the entire production period. Layers should be exposedtoabout.5to1.5fc(Onefoot-candle=

10.76 lux) for better production [4-6].

C. Plants Growth:-Deficient light intensity tend to reduce plant growth, development and yield. This is because low amount of solar energy restricts the rate of photosynthesis. Below a minimum intensity, the plant falls below the compensation point. Compensation point is the metabolic point at which the rates of photosynthesis and respiration are equal so that leaves do not gain or lose dry matter. Photosynthesis significantly slows down or ceases while respiration continues. Likewise, excessive light intensity should be avoided.

D. Museum Lighting System:- Light intensity is a primary consideration in museums to protect historic artifacts from damage. 5 to 10 foot- candles (approx. 50 to 100 lux) is currently considered to be the maximum allowable light level for very sensitive materials, such as prints, drawings,watercolors, dyed fabrics, manuscripts, and botanical specimens. Up to 15footcandles.

E. Open CV: OpenCV is an open source library for image and video analysis, originally introduced more than decade ago by Intel. Since then, a number of programmers have contributed to the most recent library developments. The latest major change took place in 2009(OpenCV

2) which includes main changes to the C++ interface. Nowadays the library has >;2500 optimized algorithms. It is extensively used around the world, having >;2.5M downloadsand >;40K people in the user group. Regardless of whether one is a novice C++ programmer or a professional software developer, unaware of OpenCV, the main library content should be interesting for the graduate students and researchers in image processing and computer vision areas. To master every library element it is necessary to consult many books available on the topic of Open CV. However, reading such more comprehensive material should be easier after comprehending some basics about Open CV from this paper.

II. SYSTEM ARCHITECTURE

The system architecture of this proposed system is following.

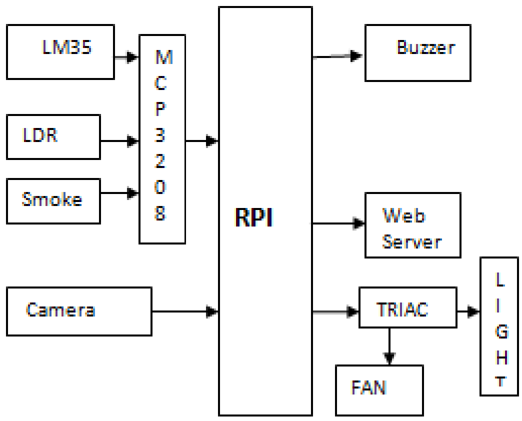


Figure.1. Block Diagram

Raspberry Pi: Hardware implementation for This proposed system is shown in above with the blocks. Raspberry Pi is the processor and its relevant components. The Wi-Fi is used for wireless communication and Wi-Fi USB module is interfaced to Raspberry Pi's USB port and sensor's data is to upload to web server and live monitoring by camera and Buzzer is used for alarm and LCD is used for display the Sensors data and TRIA C is used for switching the fan and light. When the sensors are data reached threshold limit the buzzer sound will alert.

III. IMPLEMENTATION

A. Hardware

In hardware implementation, Raspberry Pi plays a key role in monitoring in this system. The Raspberry Pi is a small computer, same as the computers with which you're already familiar. It uses a many different kinds of processors, so can't install Microsoft Windows on it. But can install several versions of the Linux operating system that appear and feel very much like Windows. Simple to use but powerful, affordable and in addition difficult to break, Raspberry Pi is the perfect device for aspiring computer scientists. This small computer features amazing HD (high-definition) quality, video playback, also sports high quality audio and has the capability to play 3D games. The device use the ARM processor which does nearly all of the hard work in order to run the Raspberry Pi. The overview of Raspberry Pi has shown below

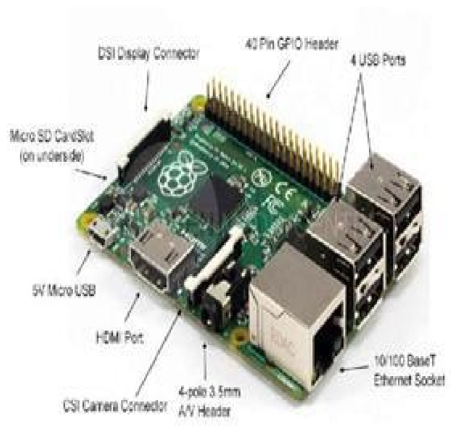


Fig.2. Raspberry Pi

1. GPIO: One powerful feature of the Raspberry Pi is the row of GPIO (general purpose input/output) pins along the Top edge of the board. These pins are physical interface between the pi and the oust side world. At the simplest Level ,you can think of them as switches that you can turn on or off(input) or that thepi can turn on or off(output).Of the 40 pins,26 are GPIO pins and other are power and ground pins. You can program the pins to interact in amazing ways with the real world. Inputs don't have to come from a physical switch. It could be input from a sensor or a signal from another computer or device, for example. The output can also do anything, from turning on LED to sending a signal or data to another device. If the Raspberry Pi is on a network, you can control devices that are attached to it from any where and those devices can send data back. Connectivity and control of physical devices over the internet is a powerful and exciting thing, and Raspberry Pi is ideal forthis.

2. Temperature Sensor: The temperature sensor will give a variable output voltage with respect to the temperature variation. LM-35 is used as temperature sensor which is a precision integrated-circuit temperature sensor, Calibrated directly in ° Celsius (Centigrade), Linear + 10.0 mV/oC scale factor with accuracy O.soC(at +25°C) with rated for full -55° to +150°C range. The Temperature Sensor which I have used in this project has shown below:

Fig.3. Temperature Sensor

3. Smoke Sensor: The smoke sensor will give a variable output voltage with respect to the temperature variation. There is better sensitivity for natural gas and coal gas. The Smoke Sensor which I have used in this project has shown below:

Fig.4. Smoke Sensor

4. LDR: LDR (Light Dependent Resistor) is variable resistor, the resistance of the LDR is inversely proportional to the light intensity, it exhibits maximum resistance in the absence of light and minimum resistance in the presence of light. The LDR which I've used in this project has shown below

Fig.5. LDR

1. MCP3208: MCP3208 devices are successive approximation 12-bit Analog-to-Digital (A/D) Converters with on-board sample and hold circuitry. The MCP3208 is programmable to provide two pseudo-differential input pairs or four single ended inputs. The MCP3208 is programmable to provide four pseudo- differential input pairs or eight single ended inputs. The ADC which I have used in this project has shown below: Differential Nonlinearity (DNL) is specified at ±1 LSB, while Integral Nonlinearity(INL)is offeredin ±1 LSB (MCP3208-B) and ±2 LSB (MCP3204/3208-C) versions. Communication with the devices is accomplished using a simple serial interface compatible with the SPI protocol. The devices are capable of conversion rates of up to 100 kbps. The MCP3208 devices operate over a broad voltage range (2.7V -5.5V).

A. *CAMERA*

.Fig.6. USB Camera

The USB camera Module is interfaced to the Raspberry Pi's USB port. The camera is mainly used to captured the changes in the environment

i.e. Motions. The required power supply to operate USB camera will get it from Raspberry Pi only.

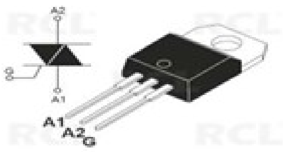
1. BUZZER: A buzzer or beeper is an audio signaling device which may be mechanical, electro mechanical, or piezoelectric. Typical uses of buzzers and beepers include devices. The buzzer which have used in this project is shown below fig:

2. TRIAC: The BT136 can be used in circuits of frequency conversion, voltage adjust and

control. TRIAC's are widely used in AC power control applications. They are able to switch high voltages and high levels of current, and over both parts of an AC waveform. This makes triac circuits ideal for use in a variety of applications where power switching is needed. One particular use of TRIAC circuits is in light dimmers for domestic lighting, and they are also used in many other power control situations including motor control. The TRAIC which I have used in this project is shown below:

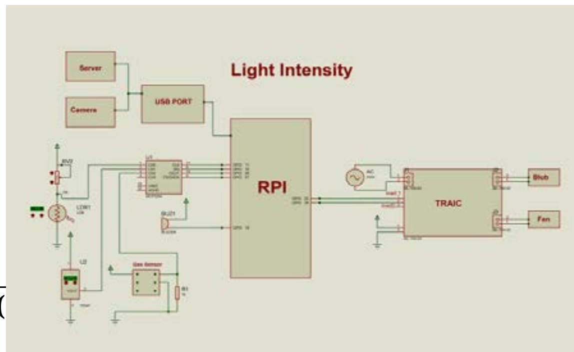
Fig.8. TRIAC.

The TRIAC is a development of the thyristor. While the thyristor can only control current over one half of the cycle, the TRIAC controls it over two halves of an AC waveform. As such the



TRIAC can be considered as a pair of parallel but opposite thyristors with the two gates connected together and the anode of one device connected to the cathode of the other, etc. However the names of these are a little more difficult to assign, because the main current carrying terminals are connected to what is effectively a cathode of one thyristor, and the anode of another within the overall device. There is a gate which acts as a trigger to turn the device on. In addition to this the other terminals are both called Anodes, or Main Terminals These are usually designated Anode 1 and Anode 2 or Main Terminal 1 and Main Terminal 2 (MT1 and MT2). When using TRIAC's it is both MT1 and MT2 have very similar properties.

A.Software Here, to program Raspberry Python was used. And a Sever as HTML Web server. Final Schematic Diagram of



this Project has shown below:

Fig.9. Schematic

IV. ALGORITHM & FLOWCHART

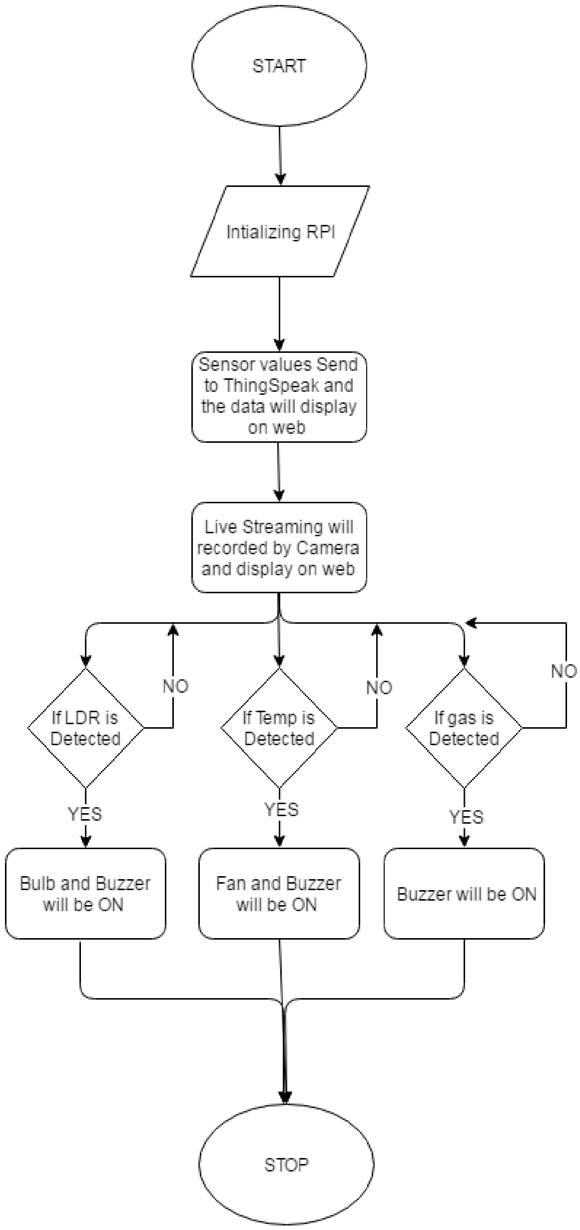
A. Algorithm

Step– 1: Initialize RPI and camera.

Step– 2: Taking sensor reading by ADC which have interfaced with RPI .

Step – 3: uploaded the Sensor's data in to web server and Live streaming by camera which have interfaced with RPI .

Step– 4:if the sensor's reached the threshold



limits the light intensity will vary and fan will turn on and buzzer will turn on.

Step– 5: continues till system runs.

B. Flowchart

The flowchart of this paper is shown below.

Fig.10. Flow Chart

V. RESULTS

Fig.11. Final Prototype

VI. CONCLUSION

The Facility manger will have skill, training and experience but lagging with lack of information to take action immediately. In the paper, we have proposed and developed cloud based light intensity, temperature and smoke monitoring system. This helps to Facility manger to take necessary action at right time, with proper controlling with can achieve desired results and we can monitor live streaming by camera. To evaluate the system, we have considered laboratory as an example but it can be used at various applications like traffic light monitoring, poultry lighting and museum lighting etc to avoiddamages.

III. REFERENCES

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[5]https://en.wikipedia.org/wiki/soil sensor

[6]https://en.wikipedia.org/wiki/Rainfallsensor