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Raspberry Pi 2 Processor Based System for the Measurement of Temperature and Light Monitoring

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ABSTRACT: Knowing weather conditions, the measurement of the temperature and Intensity of Light (variation of resistance) are very much essential and also mounting concern in our day by day living. In this paper Raspberry Pi 2 microcomputer based system is developed to monitor light intensity, temperature level of surroundings and temperature of LDR (Light Dependent Resistor). The LM35 temperature sensor and LDR sensor is used to measure temperature and intensity of light respectively. After measuring the temperature and intensity, the data is processed by Raspberry Pi 2 microcomputer system, monitored the atmospheric conditions over a small region of Sri Krishnadevaraya University, A.P.

KEYWORDS: Raspberry pi 2, MCP 3204IC (ADC), LM35 temperature sensor, LDR and Ethernet.

I.INTRODUCTION

Monitoring is employed in various applications, which includes temperature, intensity of light, voltage, and the temperature level of surroundings etc. The block diagram of experimental setup as shown in figure 1, is used to monitor and controlling the temperature and intensity of light continuously. Raspberry Pi 2 embedded system is used in this work for controlling and monitoring the physical parameters. The system can be installed at different sites like street light, outside lights, a number of indoor home appliances and cash box in shopping malls. The system (experimental setup) is very simple and it is portable. This work is divided into two parts. The first part is parameter monitoring and the second part is parameter controlling. In this system two sensors are used which are the temperature sensor and LDR (Light Dependent Resistor) for monitoring of temperature and light intensity. These two sensors are connected to MCP 3204IC and Raspberry Pi 2. The MCP 3204IC is SPI based analog to digital converter which is required in this work because Raspberry Pi 2 MCU accepts only digital values. This work is cost efficient and low cost of the sensors, portable and compatible.

II. GENERAL DESCRIPTION OF THE HARDWARE AND SOFTWARE

A. HARDWARE

Block Diagram:

The experimental setup of the hardware is shown in figure 1which consists of Raspberry Pi 2, MCP 3204 IC (SPI protocol), Temperature sensor (LM 35) and LDR (Light Dependent Resistor).

LM35 is a temperature sensor to count the temperature for various devices and converts it into electrical voltage level which is output voltage. LDR is a device, which varies the resistance with light intensity. The outputs of LM35 and LDR are connected to MCP3204 IC is (Analog to digital converter).The channels of MCP3204IC are connected to Raspberry pi 2 embedded systems. The python code is developed in Raspberry pi for data processing after receiving the required data from sensors. The power supply for Raspberry Pi 2 is 5v battery. Ethernet is used to accept the USB Hub in Raspberry pi 2. It works good condition, cost effective and portable.

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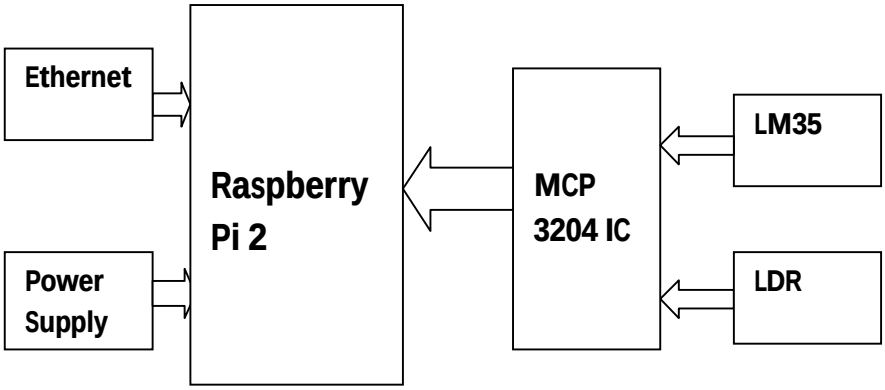

Figure 1: Experimental setup of Embedded based system.

A.1 RASPBERRY PI 2

Raspberry Pi 2 Model B is used to monitor dissimilar parameter as shown in figure 2. It is a 40 GPIO pins. The raspberry Pi is a credit-card sized board computer. The Raspberry Pi 2(2835) consists of a model B. The Raspberry Pi has been experienced with various applications and relation with normal instruments. It shows nice acknowledging with normal instrument results. It can be masked anywhere, behind television sets, within walls. It produces high interpretation. It provides basic computer functions like word processing, web browsing. [8, 9].

Figure 2: Raspberry Pi 2 board

A.2.MCP 32204 IC

The Microchip Technology Inc. MCP 3204 devices are successive approximation 12-bit Analog to Digital converters with the on-board sample and hold circuit. The MCP3204 is programmable to grant four pseudo-differential input pairs or eight single-ended inputs. The MCP3204 strategy runs over a board voltage range (2.7V-5.5V). Fewer the current designs allow work with the classic place by currents of the only 5nA and commonly dynamic currents of 320ua. It is not expensive, easy to attach and doesn't need any extra mechanism. It uses the SPI bus protocol which is supported by the Raspberry Pi's GPIO header [10]. The pin diagram of MCP3204 is as shown in figure 3.

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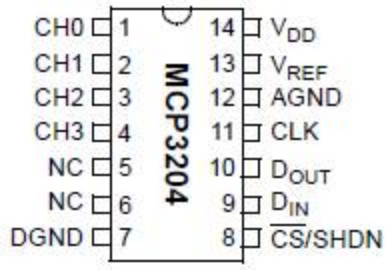

Figure 3: Pin diagram of MCP 3204IC

A.3. LIGHT DEPENDENT RESISTOR (LDR):

LDR is also called a photo resistor or a cadmium sulphide (CdS) cell or photoconductor. It is essentially a photocell that mechanism on the standard of photoconductivity. The passive module is essentially a resistor whose resistance value decreases when the strength of light increases. This optoelectronic device is naturally used in the light unreliable sensor circuit, and light and dark call up switching circuits. Some of its applications take in camera light meters, street lights, clock radios, light beam alarms, reflective smoke alarms, and outdoor clocks. LDRs are repeatedly used in circuits where it is essential to spot the presence of light, the ambient stage of light, often to generate a light triggered switch [1,2].

A.4.LM35

The LM35 series are an accuracy integrated-circuit temperature sensor. It is three-terminal appliance release an electric voltage corresponding to degree Celsius (10mv/oC). These sensors are able to determine temperature below 0C by using a pull-down resistor (+1oC from -55oC to +150oC vs. +3oC from -20oC to +100oC). Thus LM35 has an benefit over linear temperature sensors calibrated in degree Kelvin, as the user is not necessary to subtract a heavy constant voltage over linear temperature sensors calibrated in degree Kelvin, as the user is not necessary to subtract a heavy constant voltage from its output to get suitable centigrade scaling and not need any outside calibration [3, 4, 5].

A.5.ETHERNET WITH RASPBERRY PI

A direct Ethernet relation is much earlier and a more established. By concerning to our Pi in a straight line from our laptop or desktop with an Ethernet cable our and is bypassing our local network, and our aren't distribution bandwidth with other computers on our network. It also allows to relation to our Pi when our of our home network. If the undergo slow affinity and network breather with current set up, need to crack this. All we need to agreed on it up is an Ethernet cable and a plan to contact the Raspberry Pi command prompt. We've author a static IP address that we can way to connect the Raspberry Pi precisely with a laptop or desktop computer. We will care a lot improvement in velocity and establishment correlated to associating with Wi-Fi. Leave Pi associated as long as we wish without getting detached or getting network breather [8].

b. SOFTWARE DESCRIPTION

Raspberry Pi is a new microcontroller. It has a number of languages to write a program is C, C++, Java, python2 and python3. In this work python2 is used. It is a new language.

Python: Python was developed in 1985-1990 by Guido van Rossum. It is a general purpose interpreted, object oriented, high-level programming language and interactive. Python source code available under the General Public license (GPL). It is easy to enlarge with new functions and data types achieve in either C or C++ [12]. There is no header files is the main advantage of python compare other language.

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Flow chart:

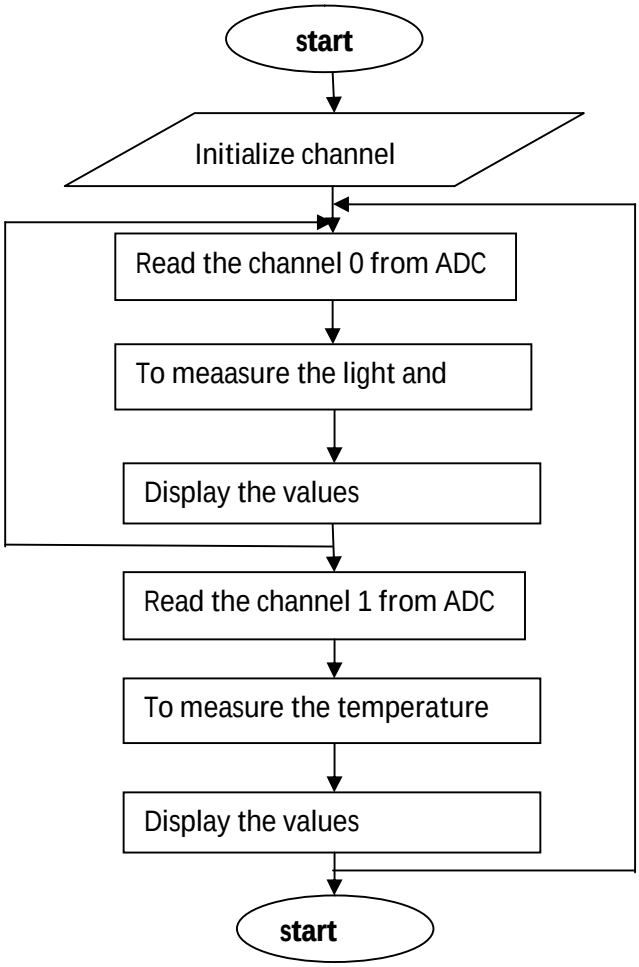

Figure 4: Flow chart

III. WORKING AND PRINCIPLE

The circuit has divided into three parts:-

a) Achieve the sensors to analog values
b) Reorganize analog values to digital values using Mcp3204Ic
c) Display the values on the laptop screen

a) **Achieve the sensors to analog values:-**

LM35IC's analog voltage is directional proportional to temperature and taken values directly in degree centigrade (^oC), which ranges as 10mv/^oC and has a heavy length from -55^oC to 15^oC. Similarly, the junction voltage of the voltage divided circuit of LDR ranges gnarly with the light energy. The comparable change in value can then be transformed into light energy.

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b) **Reorganize analog values to digital values using Mcp3204IC:-**

The voltage is sent by the MCP3204IC then converted into analog value with comparable digital values. The digital values are transformed into their various data's by the python program. The LM35IC's output voltage is precisely transformed to a temperature in degree Celsius. The atmosphere light energy is decisive using LDR; the resistances of LDR ranges gnarly with light energy the junction voltage also range gnarly and hence can be comfortably converted into lux units through python programming. Since analog values have a minor change at each one point, 120 samples of several of the voltages in 120 variables are achieved. The achieved samples are prevented and achieve into its comparable values of temperature and light energy. This operation is compassed by software programming using python programming language and it diminishes the failure from energy.

c) **Display the values on the laptop screen:-**

This system design the award recognized of the whole work. The arrange values are saved each in a desperate variable and display willingly at a daily intermission of 10 seconds. So, this complies one cycle and these cycles will advance boundlessly safe power is off [13].

IV. EXPERIENTAL RESULTS

We have achieved this work model on a set of rules of a board to most extend its alive. We proved it's an efficiency at different places and leading the values at outsides and indoors. Table 1 shows the area time and comparable review for a natural day. For a free field, we accept an open field for noting down the reviews and for a locked area we accept a room. Graphs are also conspired for the comparable review for good compassionate of the review. This work is strongly achieved and the outputs access is efficiency with a simple user alloy.

Results obtained from the developed system Raspberry Pi systems are shown in table 1. Temperature and light intensity were measured simultaneously with hardware developed in the present study at the laboratory, Dept of Electronics, S. K. University, Anantapur, Andhra Pradesh The values are graphically presented at different times using origin software.

TABLE I. Values of light and temperature of LDR

spot	Time	Temperature(^{o}C)	Light Intensity
Open area	**6:00**	**19.8**	**107.3**
Open area	**8:00**	**25.6**	**243.7**
Open area	**12:00**	**31.5**	**349.7**
Room	**14:00**	**28.9**	**267.9**
Room	**16:00**	**27.8**	**277.6**
Room	**18:00**	**24.9**	**283.7**
Open area	**20:00**	**21.9**	**13.9**
Room	**22:00**	**22.7**	**279.9**

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Plots for temperature and light intensity are shown in figures 8, 9 respectively.

In the present work the monitoring temperature and light of an LDR has been controlled LM35 using Raspberry Pi

The light and temperature measurement system is shown in figure 5 as a screen shot.

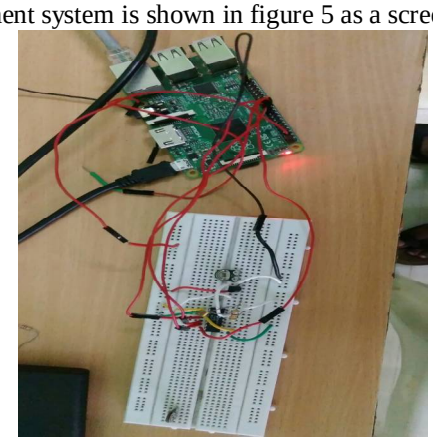

Figure.5. Photograph of the light and temperature measurement system using Raspberry Pi an MCP3204IC

The Result of the Light, Temperature and voltage values and Program in python is shown in figure 6 as a screen shot.

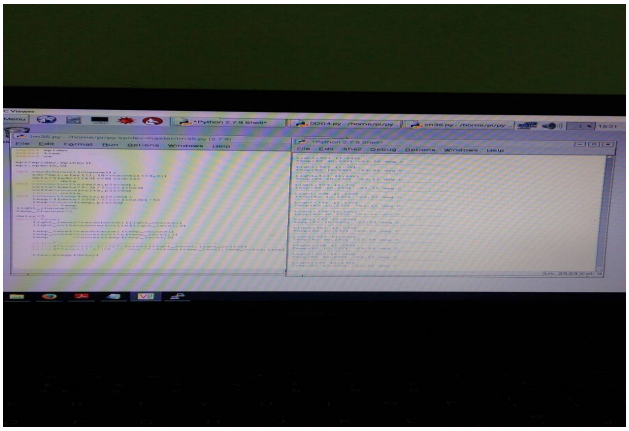

Fig.ure 6. Data acquisition and shows the results on VNC server using Python program.

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The overall of the work is shown in figure 7 as a screen shot

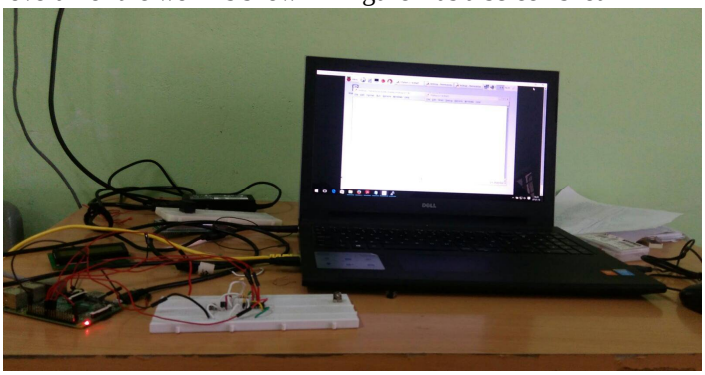

Figure.7. Photograph of total experimental setup

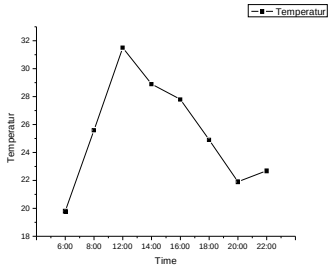

Figure 8. Graph of the temperature and time

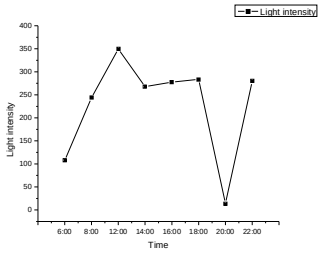

Figure 9. Graph of the light intensity and time

V. CONCLUSION

A clear coincidental monitoring system with a maximum number of components and limited complications has been composing. This system is tight and the real price is capable. When relation to the cost of components used to allotment coincidental aspect. In farther, we would comparable to the sum of barometric, pressure sensor, air-quality sensor and humidity sensor to very the atmosphere setting along with wireless communication at least price. Raspberry Pi is more compatible and require less hardware for its operators and also is inbuilt Ethernet is there. So this composes it an excellent for our enhance system.

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