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Implementation of Embedded Web Server Using TCP/IP Protocol with Raspberry PI

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***Abstract*— An Embedded web server in the device provides access to the user interface functions for the device through a device webpage. A web server can be embedded into any appliance and connected to the Internet so the appliance can be monitored and controlled from remote places through the browser in a desktop. The aim of the paper is to control the devices or equipment's from the remote place through a web page. The web-server circuit is connected to LAN or Internet. The client or a person on the PC is also connected to same LAN or Internet. By typing the IP-address of LAN on the web browser, the user gets a web page on screen; this page contains all the information about the status of the devices. The user can also control the devices interfaced to the web server by pressing a button provided in the web page.**

In the Hardware design Raspberry Pi is used and sensors such as Temperature and light are interfaced with it for controlling and monitoring of parameters from remote location.

***Keywords*— TCP/IP, Raspberry Pi2, Raspbian OS ,Sensors, client PC,Wifi.**

I. INTRODUCTION

The arrival of internet reduced the whole world communication boundary to that of a single village. After the "everybody in internet wave" now obliviously follows the "everything in the internet wave". When the embedded devices are provided with internet access, it is of no doubt that demand will rise due to the remote accessing capability of the devices. Past many years back, embedded systems and Ethernet networks existed in separate worlds. Ethernet was available only to desktop computers and other large computers. Embedded systems that needed to exchange information with other computers were limited to interfaces with low speed, limited range, or lack of standard application protocols. But developments in technology and the marketplace now make it possible for embedded systems to communicate in local Ethernet networks as well as on the Internet. Network communications can make an embedded system more powerful and easier to monitor and control. In this paper embedded systems and Internet technology are combined to form a new technology the Embedded Internet Technology, which developed with the popularization of computer network technology in recent years. The heart of communication is TCP/IP protocol. Network Communication is performed by the IEEE 802.3 Ethernet standard. It is the most modern technology of embedded systems. Since ARM embedded web server based on Raspberry Pi has fast execution capability and Ethernet standard can provide internet access with reasonable speed, this system is suitable for enhancing security in industrial conditions by remotely monitoring various industrial applications. The main purpose to develope the system is to save time and power along with maintaining security convenience.

II. EXISTING SYSTEM

Initially the electronic devices were controlled and monitored from exact location or nearby location where the device is installed. The respective person has to operate the device in the device locality. Due to which human efforts were more and remote management and running field diagnostic is absent, due to which human error is more and is less secure and less user friendly.

III. PROPOSED SYSTEM

The implementation of embedded Internet technology is achieved by means of the embedded web server. It runs on embedded system with limiting computing resources to serve web documents including static and dynamic information about embedded system to web browser. We can connect any electronic device/equipment to web server and can obtain the real-time status information and control remote equipment without time and space restriction through web page released by embedded web server. Embedded server is a single chip implementation of the Ethernet networking standard

It consists of two primary elements communicating with each other: i) a server consisting of an ARM processor with an Ethernet controller and ii) a client computer/mobile/tablet. The client computer sends/receives data to/from the arm microcontroller using TCP packets. The client has to enter IP address to access this server. This request is taken by the operating system of the client and given to the LAN controller of the client system. The LAN controller sends the request to the router that processes and checks for

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the system connected to the network with the particular IP address. If the IP address entered is correct and matches to that of the server, a request is sent to the LAN controller of the server and a session is established and a TCP/IP connection is establishes and the server starts sending the web pages to the client through which we can remotely monitor and control the sensor and device status respectively.

The architecture of embedded web server system consists of three modules as follows. Sensor module, Server node consists of Raspberry Pi with inbuilt Ethernet Controller. In sensor module, node of two sensors are developed i.e. temperature, and LDR respectively which will sense or a measure physical quantities. These measured values are transmitted to PC through serial protocol SPI and Ethernet. This transmitted data is then displayed on PC by typing IP address on the GUI design.The Temperature value displayed on Client PC,if the client want to reduce it he can control it by turning on the electric Fan.whict can reduce or lower the temperature.

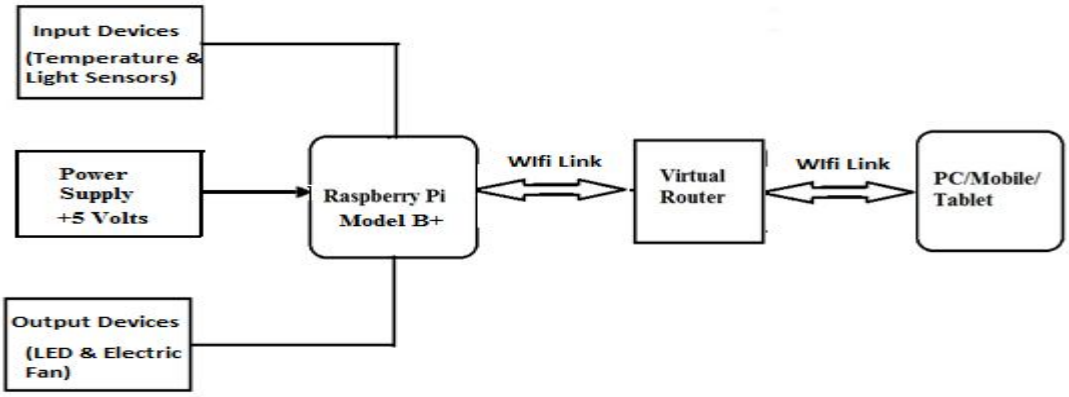


Fig.1.Block Diagram.

IV. FLOWCHART

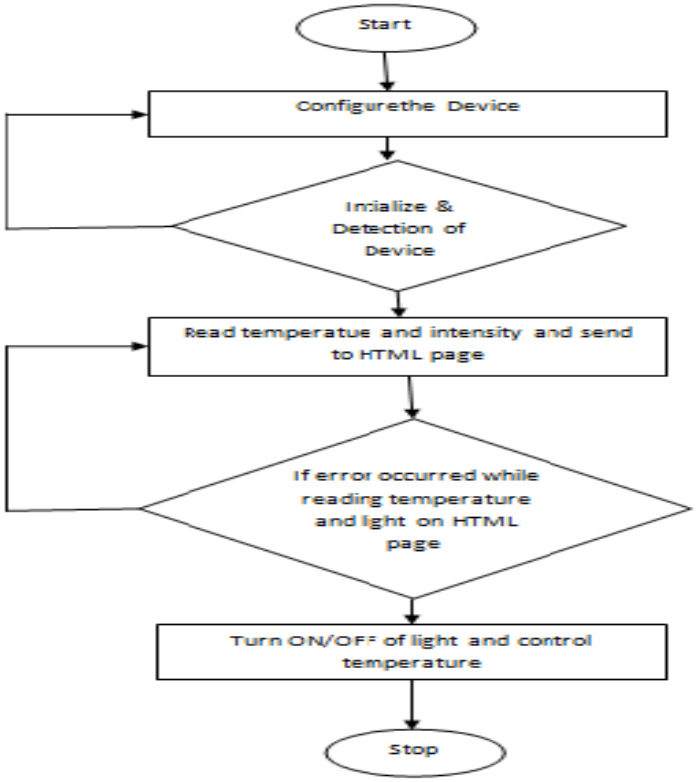


Fig.2. Flowchart

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V. HARDWARE REQUIREMENT

A. Raspberry Pi2 Module

The Raspberry Pi is a small computer about the size of a credit card. A complex IC that integrates the major functional elements in to a single chip in Raspberry Pi it is programmable processor, on-chip memory, accelerating function hardware (e.g. GPU) , both hardware and software, analog components so benefit of the use as Raspberry pi Reduce overall cost system, Increase performance, Lower power consumption ,Reduce size of hardware.



Fig.3.RaspberryPi Model B+

B. Temperature Sensor LM35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy).

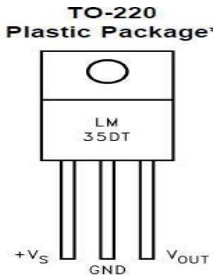


Fig.4.LM35

A. LDR(Light Dependent Resistor)

A light-dependent resistor alternatively called an LDR, photo resistor, photoconductor, or photocell, is a variable resistor whose value decreases with increasing incident light intensity. An LDR is made of a high-resistance semiconductor.



Fig.5.LDR

VI. SOFTWARE REQUIREMENTS

A. Raspbian Operating System

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Raspbian is an unofficial port of Debian Wheezy armhf with compilation settings adjusted to produce optimized "hard float" code that will run on the Raspberry Pi. This provides significantly faster performance for applications that make heavy use of floating point arithmetic operations. All other applications will also gain some performance through the use of advanced instructions of the ARM CPU in Raspberry Pi.

B. Flask Server

Flask is a micro web framework written in Python and based on the Werkzeug toolkit and Jinja2 template engine. According to Adafriut Flask server is one of the most compatible with Raspberry Pi.

C. HTML

(Hypertext mark-up language) It is used for web documents. A mark-up language is a set of mark-up tags.HTML document as are described by Tags. Each Tag describes different document content.

VII. RESULT

This hardware setup as shown in fig. when press the switch according to switch number of device ON or OFF shown in display i.e. Client P.C . After few second shows the result of temperature sensor.

The temperature sensor is the transducer that reads temperature of the room/environment, which we want to measure and converts the temperature into corresponding electrical signal. This analog signal is converted by means of analog to digital converter MCP3008 with SPI interface. The Raspberry Pi is programmed to read this digital value corresponding to temperature value. Data can be display in monitor by programming the Processor.

The HTML web page display when the configure IP address entered on the web browser. Here usingSPI module throw Raspberry pi device ON or OFF using web server throw remote place. Data monitoring on the web page, slave module data transmit and receive by the SPI module that data shown on the web page.

VIII. CONCLUSION

This project is used for monitoring parameter like Temperature and controlling Electric lamps from remote location using Raspberry Pi based embedded web server. The controlling of electric fan is being carried out depending upon temperature sensed by LM35 sensor and switching ON & OFF of electric blub is being controlled depending upon signal sensed by LDR.In this Project Turning ON LED is done using Raspberry It is possible to interface different kind of Sensors and make various network monitoring applications through internet using TCP/IP protocol.

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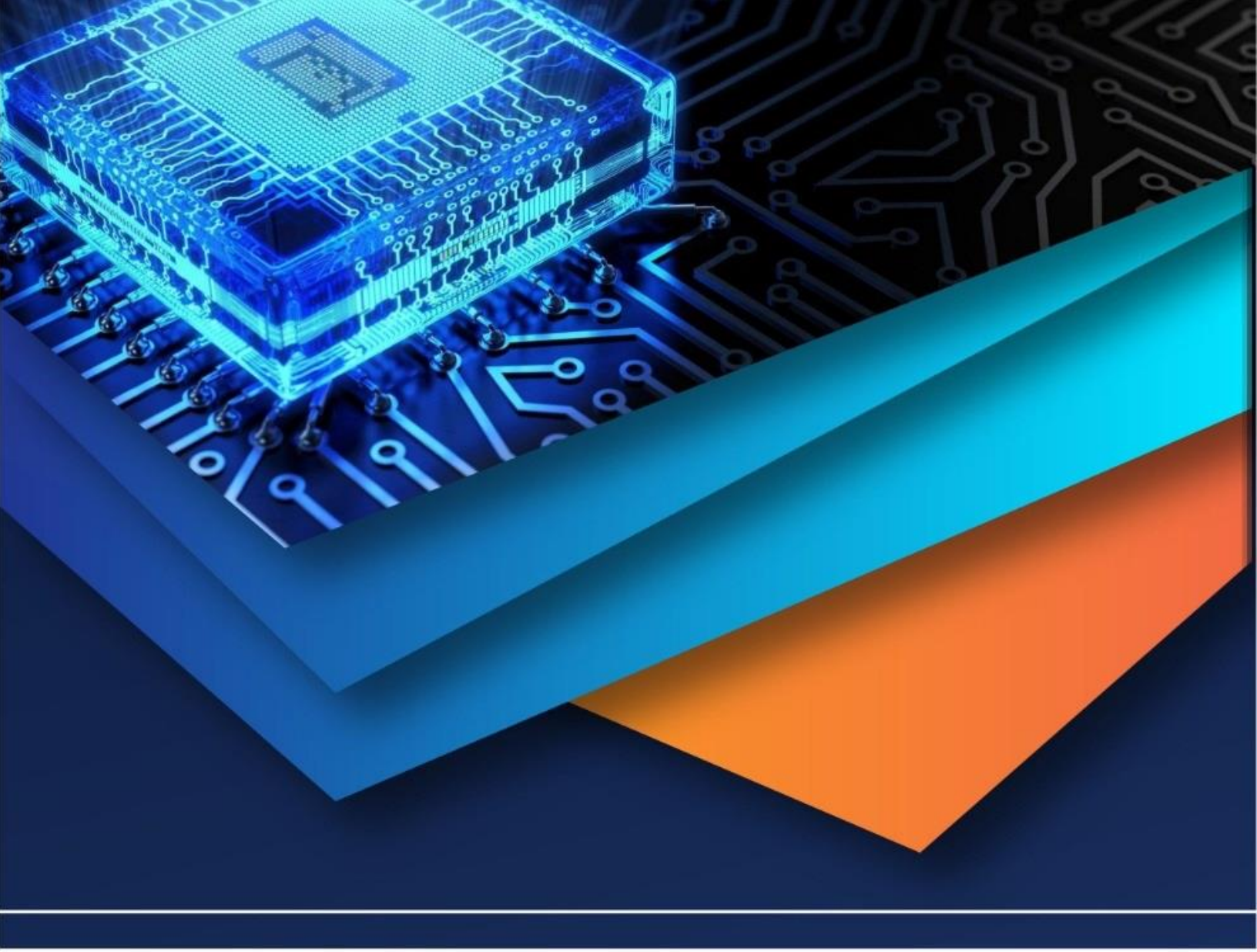
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