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IOT Based Lab Automation

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Abstract*: *In this paper we presented the a Lab Automation System (LAS) using Node MCU ESP 8266 that employs the integration of cloud networking, wireless communication, which provide the user with remote control of lights, fans, and appliances within their lab and storing the data in the cloud. The system will automatically change on the basis of sensors' data. This system is designed with low cost and expanded in lab to control variety of devices.
Keywords: IOT- internet of things, WLAS wireless lab automation system, IOT- internet of things, WLAS- wireless lab automation system. This makes wireless installations a seminal investment.

I. INTRODUCTION

Labs will become more and more self-controlled and automated due to the comfort it provides, especially when employed in a private lab. Lab automation system is a means that allow users to control electric appliances. Many existing, well established lab automation systems are based on wired communication. In contrast, Wireless systems can be of great help for automation systems. With the wireless technologies such as Wi-Fi, cloud networks in the recent past, wireless systems are used every day and everywhere. The main objective of this project is to develop a lab automation system with a touch screen based control panel. As technology is advancing so labs are also getting smarter. Modern labs are gradually shifting from conventional switches to centralized control system, involving touch screen switches. Presently, conventional wall switches located in different parts of the lab makes it difficult for the user to go near them to operate. Touch screen control panels are also designed for commercial, industrial and medical systems. In order to achieve this, a touch panel is interfaced to the microcontroller on transmitter side which sends ON/OFF commands to the receiver where loads are connected. By touching the specified portion on the touch screen panel, the loads can be turned ON/OFF remotely through wireless technology. The microcontroller used here is of 8051 family.

Information is traversed between devices so that processes can be automated, without the need for human intervention. By reducing the number of people involved in a business process, several advantages arise, including improved accuracy and up-time. The system will automatically change on the basis of sensors' data. This system is designed with low cost and expanded in lab to control variety of devices

II. BLOCK DIAGRAM

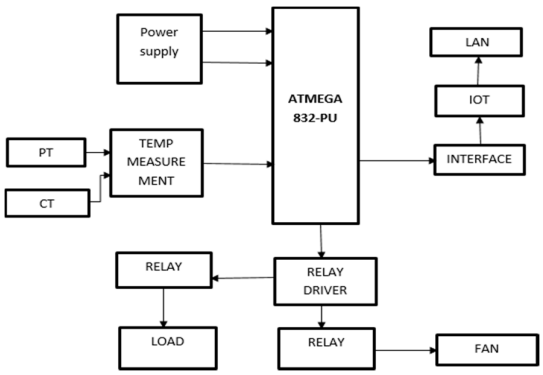

Fig: Block Diagram of system

The measured signals are preconditioned as described before they are transmitted to a remote access point and a control station (personal computer). The system features two-way communication capability which enables synchronized data transfer acquisition. Lab automation systems which is referred here, face four main challenges, these are high cost of ownership, inflexibility, and difficulty in achieving security. The main objective of this work is to implement an existing lab automation system using IOT that is capable of controlling and automating most of the house appliances through an easy manageable web interface. The proposed system has great flexibility by using Wi- Fi technology to interconnect its distributed sensors to lab automation server. This will decrease the deployment cost and will increase the ability of upgrading and system reconfiguration.

A. IOT Implemented System Feature:

Server controls and monitors the various sensors, and can be easily configured to handle more hardware interface module (sensors). The Node cu esp8266 development board, with built in Wi-Fi card port to which the card is inserted, acts as web server. Automation System can be accessed from the web browser of any local PC in the same LAN using server IP, or remotely from any PC or mobile handheld device connected to the internet with appropriate web browser through server real IP(internet IP). Wi- Fi technology is selected to be the network infrastructure that connects server and sensors. Wi-Fi is chosen to improve system security (by using secure Wi-Fi connection), and to increase system mobility and scalability.

B. Automatic Light Design

In this automatic lamp system, the input is obtained from the LDR sensor. The LDR sensor serves to provide information about the intensity of light around. This information will be used by the microcontroller to make a decisions whether or not the light is turned on. In this process the lamp will light up when the light is Dark (the light intensity is less than equal to 700) and the lamp will off again when the light is bright (the light intensity is greater than 700). For more details about this automatic lamp process can be seen in Figure.

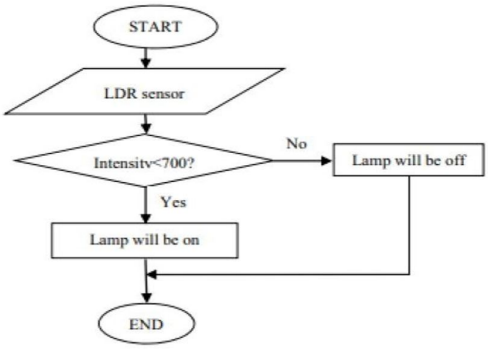

Fig: Flow chart of light control

C. Fan Control Unit

Automatic Fan Design In this automatic fan system, the input is obtained from DHT11 sensor. The DHT11 is a dual temperature and humidity sensor, meaning that it can read both temperature and humidity. Microcontroller will receive input data from the sensor and will process it into output on the fan. The input of this sensor is the amount of temperature in the room, then we have to set program on the desired temperature and output fan speed limits. If the sensor's read temperature is less than 25°C then the fan will off or will not rotate. If the temperature reads the sensor between 26 – 29°C then the fan will spin slowly. If the temperature reads the sensor between 30 – 34°C then the fan will spin at medium speed. Then if it exceeds 35 °C then the fan will spin rapidly. For more details about the process of this automatic fan detection can be seen in Figure.

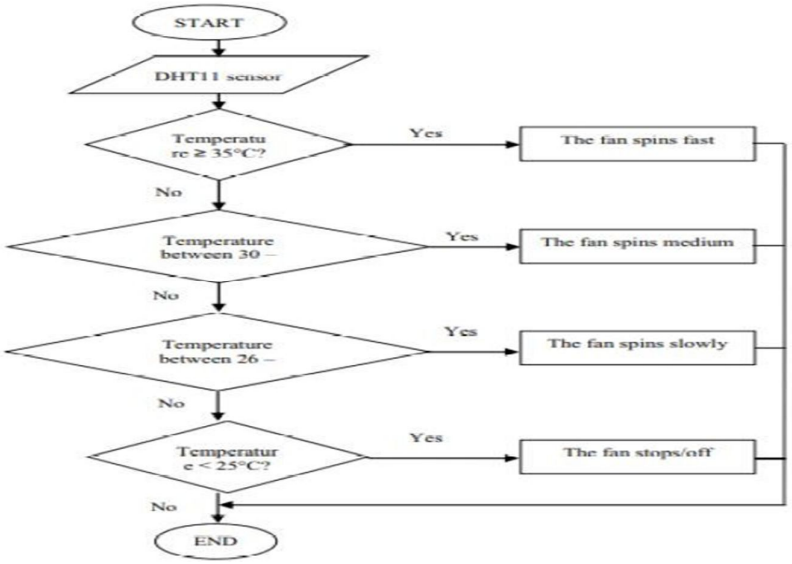

Fig: Flow chart of fan control HARDWARE DESIGN

D. Schematic View of Fan Domain

This was this proposed system which will run on Internet of Things on PCs, which will control the home appliances. Using this system one can control appliances of their home by simply using the web application from anywhere in the world. The application works real time, hence there is negligible delay. As a practical use housing appliances like lights are controlled along with speed of fan. Many existing and well-established home automation systems have been based on wired technologies traditionally, which does not use Internet of Things, which is too slow in speed, and covers very short range of distance. Not a problem until the system is planned well in advance and installed during the ip for such thing actual construction of house However in already existing buildings the implementation cost for the same is very high. In contrast wireless systems are of great.

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IV. IOT COMPUTER CONTROL

During the IOT Process the computer shows the details i.e. the measurement unit about the load using the internet server. The user can control the load from a distant either to load ON or OFF.

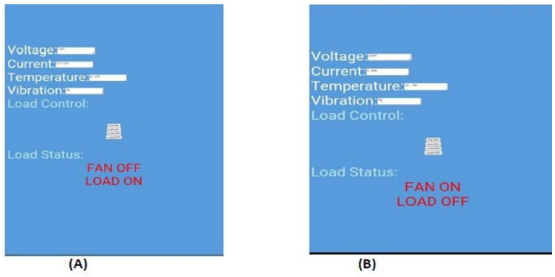

Fig (a) IOT Computer control (Fan off) (b) IOT computer control (Fan on)

The hardware system of the proposed model is shown in the Fig. Here is a circuit containing Atmega328 micro- controller with its all basic components as shown. For power supply to provide 5V, the circuit consists of step down transformer of 230/12V. This transformer steps down 230V AC from main supply to 12V AC. Then that 12V AC is converted into 12V DC with the help of bridge rectifier. After that a 1000/25V capacitor is used to filter the ripples and then it passes through voltage regulator 7805 which regulates it to 5V. There is ULN 2003 IC driver is connected to the port D of micro–controller. All the loads are individually connected to this ULN 2003 IC driver 18 through a separate relay. There is Fan connected at pin 12 of micro controller through MOC 3021 and Triac BT136 for controlling the speed of Fan. There is Ethernet shield module with its all basic is connected to the port B of Atmega 328 micro – controller. The Arduino Atmega328 creates a HTML page on WLAN network through which it is connected for controlling the loads and Fan speed.

Fig: Hardware setup

The IOT Hardware consists of the controller, modem, sensors for the control of temperature, LCD Display, switch, loads. According to the load the monitor displays the measuring details in the LCD Display.LM35 is the Temperature Sensor possess low self-heating and does not cause more than 0.1 ºC temperature rise in still air. The operating temperature range is from 100 ºC to 150 ºC. The Colpitts Oscillator is used for running the relay driver circuit. It is a capacitive voltage divider network as its feedback source. The Rectifier used for the controller is bridge-rectifier. It acts as a switching control for the load.

Fig: IP address display

A particular IP Address is generated in the LCD at an instance by the modem provided. With the help of the internet server, on providing the IP address, the connected load measurements are monitored and controlled. The IOT Control thus acts as an interface between the controller and the server. For minimizing the power consumption, a unidirectional data transmission scheme was used, and the sensors waking up periodically, powering up the attached sensors, taking the measurements, and sending the data using the Wi-Fi module and the UDP protocol. The choice of protocol was motivated by the lower packet size, increased speed, and low latency compared with that of TCP/IP and by the fact that it offers connectionless communication.

A. Hardware Design Light:

The designing of the proposed system for controlling light using IoT is done and it is concluded that it is more efficient than the existing manual street lightening system and in future this system will be used for street lighting. Here are some images of the demo project solution. Figure 14 show the implementation of the street lightening system.

Fig: Light control hardware

B. ARDUINO ESP8266 ESP8266:

It is an impressive, low cost WiFi module suitable for adding WiFi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone WiFi connected device-just add power! The feature list is impressive and includes: 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack. NodeMCU is an open source IoT platform.

Fig: NodeMCU

In the above figure is a NodeMCU esp8266 microcontroller used in the proposed lab automation system installed in the laboratory. This microcontroller comes with the inbuilt Wi-Fi module.

Fig: Connection of IOT Lab Automation

C. System with AC Mains:

The above figure shows the connection procedure of the relays used in the lab automation with the AC mains. The NC terminal of the relay is been connected in parallel to the ground line of the wire. The COM is been connected to the 230V supply line of the switch board circuit.

V. SYSTEM WORKING

A. Working of Hardware part Light Controlling Mechanism

This mechanism automating the light controlling system, in which a person enters the lab the PIR sensor detects the motion of the object (person) and sends the signal to Rpi. According to the output of PIR sensor that is if PIR sensor gives high output (i.e. person is detected) then next module will called that is LDR sensor. It will check present intensity level, if present intensity level is below threshold value then light will turn ON otherwise light will remain OFF. A good lighting design includes a good controls design. Lighting controls play a critical role in lighting systems, enabling users manually or automatically to turn the lights ON and OFF using a switch; and/or • adjust light output up and down using a dimmer.

This basic functionality can be used to generate these benefits for the lighting owner:

--Flexibility to satisfy user visual needs; and/or automation to reduce energy costs and improve sustainability.

In recent years, lighting controls have evolved two additional capabilities:

--adjust light source colour, including shade of white light; and/or generate data via measuring and/or monitoring.

Based on an update to LCA Education Express EE101: Introduction to Lighting Control, this article provides an overview of the basic functionality of today's lighting controls, benefits and the basic questions to ask when identifying an appropriate lighting control strategy.

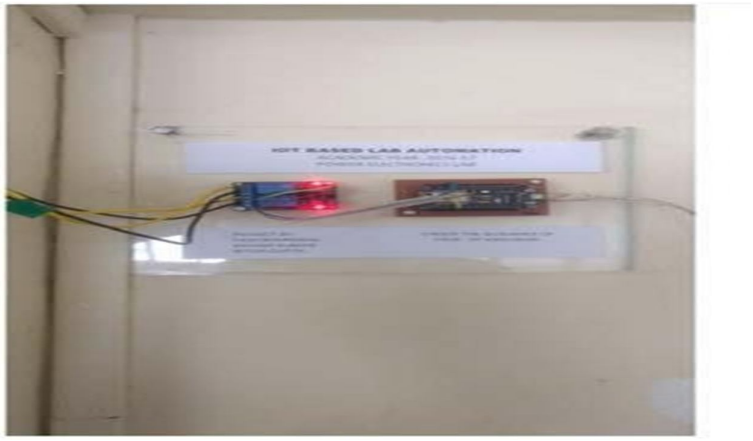

Fig: Practical implementation

VI. CONCLUSION

IOT system integrates electrical devices in labs with each other. The techniques which are going to use in lab automation include those in building automation as well as the control of domestic activities, such as fan, electric tubes, etc. After studying and understanding literature survey and other existing works, we proposed a technique that will gives us better understanding of the Environmental conditions in lab. We also provide notification to the user about any error occurs in the devices. In this paper we are planning to eliminate most of the human interaction by providing intelligent system. Development of such system by using Internet of Things technology. By using these system we can actually manage to make low cost, flexible smart labs to adjust its environmental conditions and resolve its errors with energy saving.

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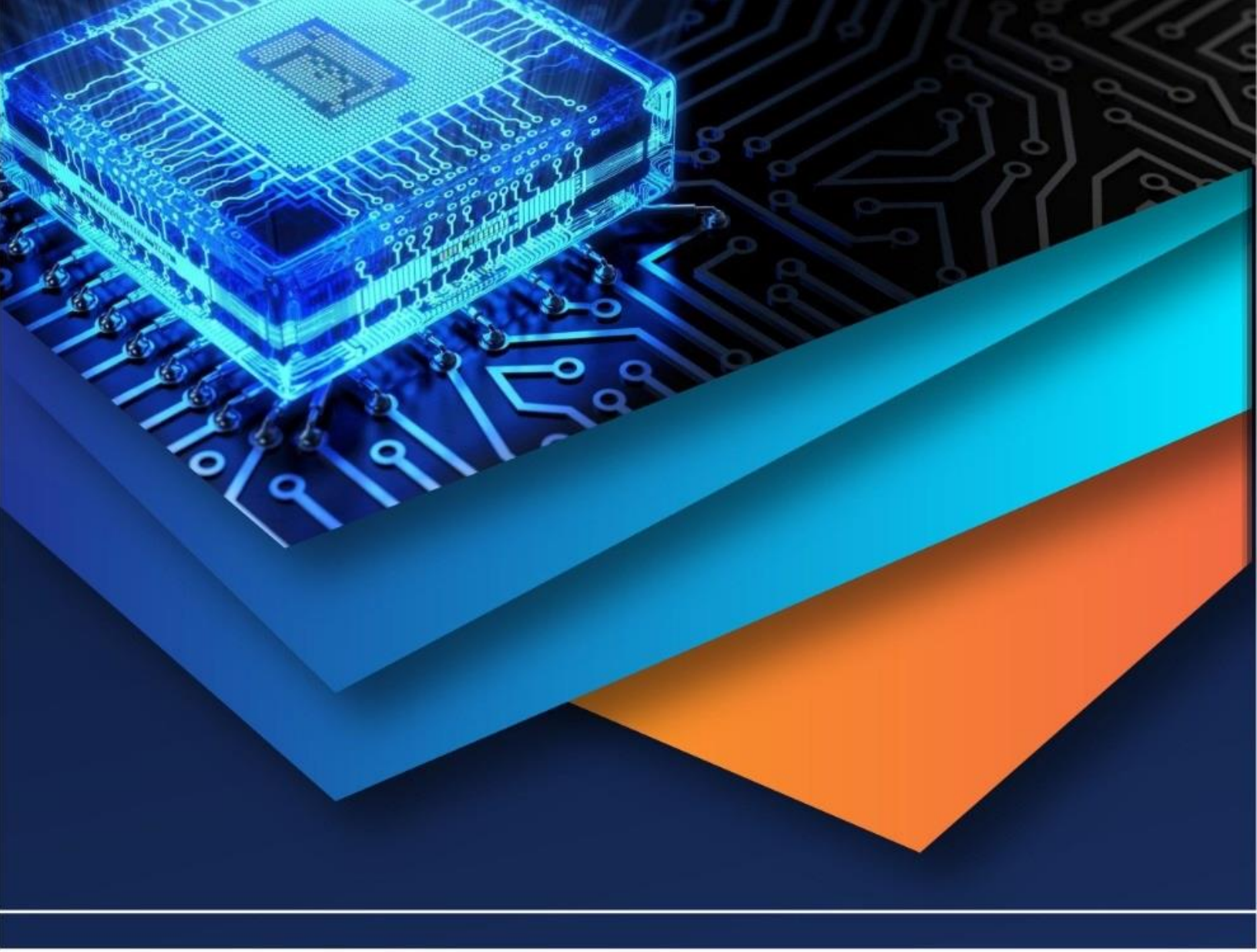

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