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Real Time Lab Automation System Using IOT

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Abstract— **In this paper Lab Automation System Using IOT is proposed. In recent years, these systems are based on display meters within wired. As it employs wires it causes inflexibility, poor manageability and high cost etc. To overcome the above issues, Lab Automation System Using IOT is preferred. In wireless system will reduce complexity and increases flexibility. Meanwhile it approaches digital uses of electrical equipment's. Here DC shunt and series motor chosen to implement above methodology. By implementing voltage, current, speed sensors in the motor; concerned parameters are applied. Measured variables are transferred to the display device and smart phone applications using IOT. Here monitoring and displaying electrical equipment's are proposed in future, Controlling of electrical equipment's maybe preferred.**

***Index Terms* — *IOT- Internet of Things, WLAS-Wireless Lab Automation System*.**

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 anywhere and everywhere. Reduced installation costs-First and foremost, installation costs are significantly reduced since no cabling is necessary. Wired solutions require cabling, where material as well as the professional laying of cables (e.g. into walls) is expensive. System scalability and easy extension- Deploying a wireless network is especially advantageous when, due to new or changed requirements, extension of the network is necessary. In contrast to wired installations, in which cabling extension is tedious. This makes wireless installations a seminal investment. Integration of mobile devices-With wireless networks, associating mobile devices such as PDAs and Smartphones with the automation system become s possible everywhere and at any time, as a device's exact physical location is no longer crucial for a connection (as long as the device is in reach of the network). The proposed system has a 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 grading, and system reconfiguration.

II. BLOCK DIAGRAM

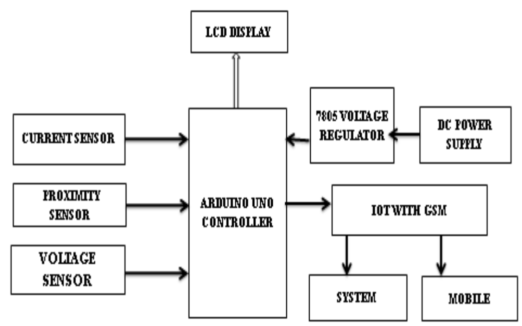

Fig. 1. Block diagram.

In this block diagram initially three sensors has been used as an input like current, voltage and proximity sensors. The current sensor senses the current in the circuit and the voltage sensor senses the voltage of the motor and also proximity sensor senses the speed of the shaft. These all three sensors are fixed in the D.C machines. The output of these sensors are in an analog form, which were given to the main controller Arduino ATMEGA328p.For the operation of this controller 230v dc power supply is given. In arduino controller analog signal are converts into digital by the usage of ADC. From this controller so the outlook will be categorized into two ways. The primary digital output readings were visualized in 2x16 LCD display and then the secondary output displayed in the systems or mobile phones through internet of thing (IOT).

I. III. ARDUINO ATMEGA328P

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consist other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. The 14 digital input/output pins can be used as input or output pins by using pin Mode, digital Read and digital Write functions in arduino programming. Each pin operate at 5V and can provide or receive a

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maximum of 40mA current, and has an internal pull-up resistor of 20-50 KOhms which are disconnected by default.

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Fig. 2. Arduino Atmega328P

A. *A. Specification*

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader.
- SRAM: 2 KB
- EEPROM: 1 KB

B. *B. Special Pin Function*

Each of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pin Mode, digital Write, and digital Read functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference function.

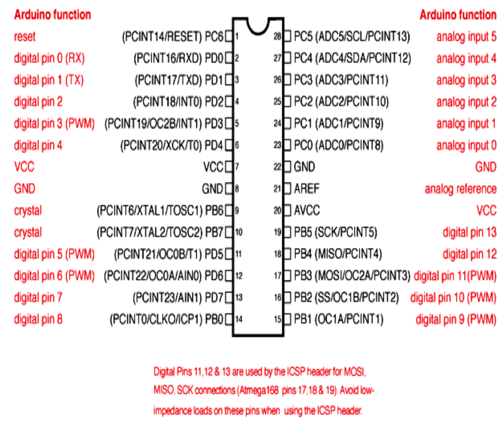

Fig. 3. Pin diagram

C. *C. Out of these 14 pins, some pins have specific functions as listed below*

- Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
- External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analog Write function.
- SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.
- In-built LED Pin 13: This pin is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off.
- Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library. Arduino Uno has a couple of other pins as explained below:
- AREF: Used to provide reference voltage for analog inputs with analog Reference function.
- Reset Pin: Making this pin LOW, resets the microcontroller

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II. CIRCUIT DIAGRAM

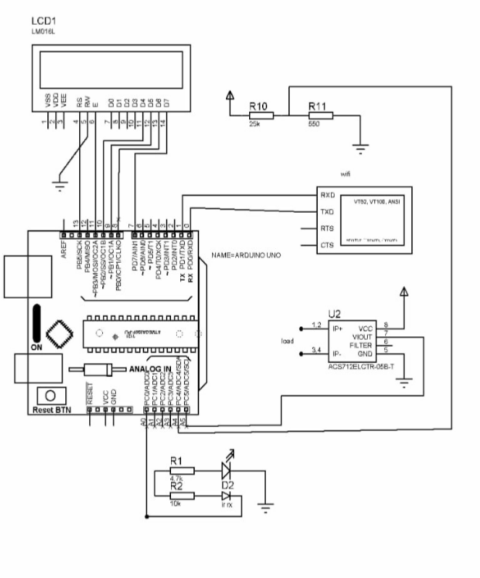

Fig. 4. Circuit Diagram

V. INTERNET OF THINGS (IOT)

Internet of Things (IoT) is a new revolution of the Internet. It makes Objects themselves recognizable, obtain intelligence, communicate information about themselves and they can access information that has been aggregated by other things. The Internet of Things allows people and things to be connected Anytime, Anyplace, with Anything and Anyone, ideally using Any path/network and Any service. This implies addressing elements such as Convergence, Content, Collections, Computing, Communication, and Connectivity. The Internet of Things provides interaction among the real/physical and the digital/virtual worlds.

A. *A. Application Domains*

The Applications of the IOT are numerous and diversified in all areas of every-day life of people which broadly covers society, industries, and environment. All the IOT applications developed so far comes under these three broad areas as shown in. According to Internet of Things Strategic Research Agenda (SRA) during 2010, 6 or more application domains were identified that are smart energy. According to the survey that the IOT-I project ran during 2010 65 IOT application scenarios were identified and grouped in to 14 domains, which are Transportation, Smart Home, Smart City, Lifestyle, Retail, Agriculture, Smart Factory, Supply chain, Emergency, Health care, User interaction, Culture and tourism, Environment and Energy. Some of the IOT applications.

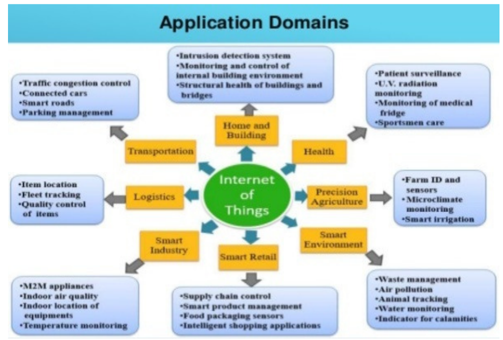

Fig. 5 .Application flow chart

III. VI. CURRENT SENSOR

ACS712 Current Sensor Module-20A can sense upto 20A of current flow. Sensing and monitoring the current flow is a fundamental requirement in wide variety of applications, which includes over-current protection circuits, battery charger, switching mode power supplies, digital watt meters, programmable current sources, etc, ACS712 Current Sensor Module-20A is based on ACS712 sensor, which can accurately detect DC current. The maximum DC that can be detected can reach 20A, and the present current signal can be read via analog I/O port of a microcontroller or an Arduino.

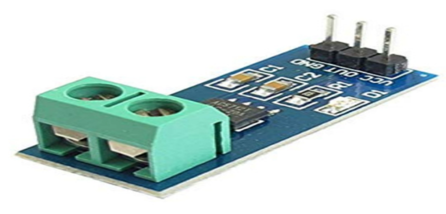

Fig. 6. Current sensor

A. *Working Principle*

As mentioned before, these modules are primarily for use with microcontrollers like the Arduino. In those applications, the connections would be as picture below:

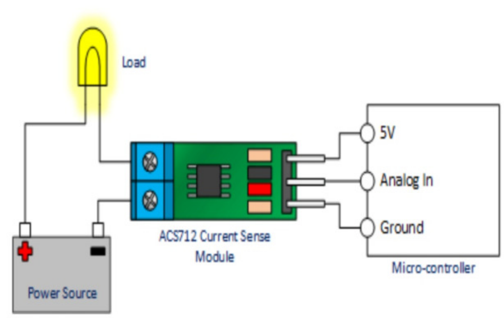

Fig. 7. Working of current sensor

ACS712 current sensor operates from 5V and outputs analog voltage proportional to current measured on the sensing terminals. You can simple use a microcontroller ADC to read the values. Sensing terminal can even measure current for loads operating at high voltages like 230V AC mains while output sensed voltage is isolated from measuring part.

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B. VII. VOLTAGE SENSOR

The primary function of voltage sensor is to senses DC voltage and gives for the measurements. The sensors provide an output in the form of analog voltage signal.Voltage sensoris a device that senses the DC voltage and gives further measurement. The sensors provide an output in the form of analog voltage signal by using scaling method it converts into digital output.

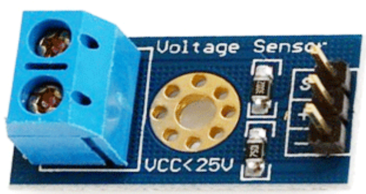

Fig. 8. Voltage sensor

C. *Working principle*

The voltage sensor module is based on principle of resistive voltage divider design, can make the red terminal connector input voltage to 5 times smaller. Arduino analog input voltages up to 5V, the voltage detection module input voltage not greater than 5V*5=25V.

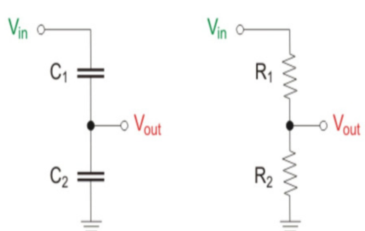

Fig. 9. Circuit diagram

The input to the voltage sensor is the voltage itself and the itself and the output can be analog voltage signals, analog current level, frequency or even frequency modulated outputs. That is, some voltage sensors can provide sine or pulse trains as outputs and others can produce Amplitude Modulation, Pulse Width Modulation or Frequency Modulation outputs.

IV. VIII. PROXIMITY SENSOR

This is an infrared Transmitter and Receiver which together make up a Photoelectric sensor and it shows a digital output.IR Proximity Sensor is essential to sense shaft speed . Typically , device used for this purpose are shaft (rotary type) encoders , photoelectric (optical type) sensors send data in the form of electric pulses.

Fig. 10. Proximity sensor

The Infrared Reflectance Sensor Module simply gives a digital signal when it detects Infrared reflection from a person or object, so the code is exactly as the one we would use for a push button. The Infrared Proximity switch model is a reflection type photo electric sensor which integrates transmiting and receiving Infrared beam function. Infrared Proximity switchs work by sending out beams of invisible Infrared light.

V. IX. DC SHUNT MOTOR

In electrical terminology, a parallel circuit is often referred to as a shunt. Hence, DC motors in which the armature and field windings are connected in parallel are referred to as DC shunt motors. The variations in construction between series-wound DC motors and DC shunt motors result in some differences in operation between the two types, but the most significant difference lies in their speed characteristics. Where a series-wound DC motor exhibits a direct, inverse relationship between load and speed, a DC shunt motor is able to maintain a constant speedregardless of the load on the motor.

Fig. 11. DC shunt motor

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VI. X. DC SERIES

The stator is made up of two or more electromagnet pole pieces, and the rotor is comprised of the armature, with windings on the core connected to the commutator. The output power source is connected to the armature windings through a brush arrangement connected to the commutator. The rotor has a central axle about which the rotor rotates. The field winding should be able to support high current because the greater the amount of current through the winding, the greater will be the torque generated by the motor. So the winding of the motor is made up of thick heavy gauge wire. Heavy gauge wire does not allow a large number of turns. The winding is made up of thick copper bars as it helps in easy and efficient dissipation of heat generated as a result of flow of large amount of current through winding.

Fig. 12. DC series motor

XI. CONCLUSION

This paper concludes the Lab Automation System using IOT has been implemented by fixing a sensor in DC machines (shunt, series). Here the necessary parameters of DC machines like current, voltage and speed are monitored and displayed in LCD and also it can be visualized in mobiles/systems by enabling IOT features. The proposed system can be easily upgraded to add other sensors on the sensing node for the measurements of other parameters if required. This will help the user to analyze the condition of various parameters in the lab anytime anywhere. The concept of IOT is presented for monitoring the motor and displaying the parameters values. The system has a high autonomy, easy installations and low maintenances costs. Experimental results confirm the flexibility of the implementation of the systems.

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