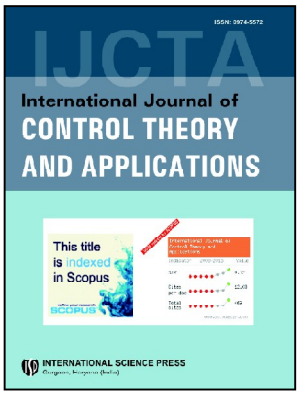


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# Remote Digital Circuit Emulation and Verification Using Adruino Board through WIFI Enabled Internet of Things (IoT)

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***Abstract:*** The opportunities opened by the Internet of Things (IOT) are being incorporated to eLearning with a specific end goal to upgrade the learning background. Wifi enabled IoT nodes are like recreation strategies in that they require minimum space and time, and the applications can be quickly designed and keep running over the Internet. In any case, not at all like reenactments, they give genuine information. The objective of this paper is to control remote IoT nodes or circuits through wiFi. The node side has an arduino controller which is wired to the diverse nodes or discrete parts and utilizing this setup distinctive combinational and consecutive capacity can be copied and furthermore tried for usefulness verification. The discrete circuits are nodes with the arduino controller going about as the controller. The objective of this research is to set up IoT nodes that can be coordinated through android based versatile App with WIFI channel.

***Keywords:*** Internet of Things, Arduino, Wifi, Circuit Verfication.

## INTRODUCTION

Internet of Things (IoT) is an element worldwide system framework with self-designing capacities in light of standard and interoperable communication protocols where physical and virtual "things" have characters, physical characteristics and virtual identities and utilize wise interfaces and are flawlessly coordinated into the data arrange. Arduino senses the environment by getting contributions from numerous sensors, and influences it's encompassing by controlling lights, engines, and different actuators. Arduino is an open-source prototyping stage in view of simple to-utilize hardware and software. Arduino boards can read inputs-light on a sensor, a finger on a button, or a twitter message and transform it into a yield enacting an engine, turning on the LED, distributing something on the web. The client can do activities on Arduino board by sending an arrangement of guidelines to the microcontroller on the board. The advantage of Arduino incorporates economical, cross-stage, straightforward, clear programming environment, open source and extensible programming and open source and extensible hardware.

## RELATED WORKS

The combination of sensors and correspondence advancements gives an approach to us to track the changing status of a question through the Internet. IoT advances can be utilized to share under-used assets. Cloud computing systems are talked about in this paper. Multilayer methodologies and SOA proposed as the fundamental design to build different vehicular cloud service platforms. In this paper remote sensor network coordinate with cloud computing, another era of IoT-based vehicular data cloud is produced. The proposed IoT-based vehicular data cloud platform supports three new cloud benefits as Infrastructure as a Service, Storage as a Service and Platform as a service. In this paper, a novel particular and multilayered vehicular data cloud platform in view of cloud computing and IoT advances are introduced. IoT and cloud computing give tremendous chances to innovation advancement in the vehicle business and will fill in as empowering frameworks for creating vehicular data cloud is talked about in this paper [1].

So as to understand the full sharing, free course, on-demand utilize, and ideal distribution of different assembling assets and abilities, the uses of the innovations of IoT and Cloud Computing in assembling are examined in this paper. The IoT innovation is connected to understand the recognition, web connection, and securing of MRs&Cs, and CC technologies is utilized to understand the accumulation, administration, ideal portion, and on-demand utilization of MRs&Cs as administration. In this paper, with the application and support of IoT and CC technologies, the insightful administrators of 4C (i.e., intelligent perception and Connection, Communication, Computing, and Control) of different MRs&Cs is acknowledged [2].

In this paper, new technique is proposed to outline a reconfigurable smart sensor interface for modern WSN in IoT environment, in which complex programmable logic device (CPLD) is embraced as the center controller. The standard of IEEE1451.2 intelligent sensor interface particular is received in this paper. IP center module of IEEE1451.2 corresponding protocol in its CPLD is programed to find sensors interface with it consequently. IEEE1451 protocol will have an expansive space for advancement in the range of WSN in IoT environment is examined in this paper. Realtime observing of water environment in IoT environment is checked that the framework accomplished great impacts in down to earth application [3].

So as to accomplish insightful observation and access of different assembling assets, the uses of IoT advances in cloud assembling is explored in this paper. A model application framework is created to legitimate the proposed technique. Intelligent perception, connection and access of different assembling assets and capacities, the assembling assets are figured it out. A five-layered structure of assembling asset wise observation and get to framework in view of IoT is outlined and exhibited. The definite technique and structure for understanding the smart discernment and access of hard assembling assets, computational assets, and scholarly assets is examined [4].

In this paper, the platform involves an open-platform-based intelligent medicine box (iMedBox) with enhanced connectivity and interchangeability for the integration of devices and services; intelligent pharmaceutical packaging (iMedPack) with communication capability enabled by passive radio-frequency identification (RFID) and actuation capability enabled by functional materials. The proposed platform seamlessly fuses IoT devices with in-home healthcare services for improved user experience and service efficiency. This paper presents an IoT-based intelligent home-centric healthcare platform (iHome system), which seamlessly connects smart sensors attached to human body for physiological monitoring and intelligent pharmaceutical packaging (iMedPack) for daily medication management [5].

In this paper, the platform includes an open-platform-based intelligent medicine box (iMedBox) with upgraded availability and compatibility for the incorporation of device and services; intelligent pharmaceutical packaging (iMedPack) with correspondence capacity empowered by uninvolved Radio-Frequency ID (RFID) and activation ability empowered by utilitarian materials. The proposed platform flawlessly intertwines IoT devices with in-home healthcare services for enhanced client experience and service effectiveness. This paper

exhibits an IoT-based intelligent home-centric healthcare platform (iHome framework), which flawlessly interfaces brilliant sensors joined to human body for physiological observing and intelligent pharmaceutical packaging (iMedPack) for day by day solution management [5].

This paper presents a novel algorithm that builds the productivity of the present cloud-based intelligent smart-parking system and builds up architecture in light of the Internet-of-Things technology. This paper executes a framework model with remote access in an open-source physical computing platform in view of Arduino with RFID technology utilizing a smartphone that gives the correspondence and UI for both the control framework and the vehicles to check the possibility of the proposed framework. Arduino Uno R3 and Arduino Ethernet Shield utilized as a part of this paper. A parking system that enhances execution by lessening the quantity of clients that neglect to discover a parking spot and limits the expenses of moving to the parking spot is accomplished [6].

This paper examines different advances and issues with respect to green IoT, which additionally diminishes the vitality utilization of IoT. Cloud platform is a computational piece of IoT, since it is utilized for handling different information progressively and separating a wide range of important data from the assembled information. A usually utilized business WSN arrangement depends on the IEEE 802.15.4 standard. This paper has talked about different advances and issues as for green IoT, which assumes a noteworthy part in accomplishing a supportable smart world [7].

This paper builds up a particular visual interface and open information support platform to be coordinated into smart urban cities in the field of Data Visualization. Gathered data from Arduino boards with sensors/ actuators represented in maps, encouraging the representation of data and upgrading its control. This introduces the idea of Collections and some pilot testing to reproduce and associate IoT devices to begin populating the Open Data repository [8].

IoT is the most recent and rising web innovation. In this paper a Home Automation system (HAS) utilizing Intel Galileo that utilizes the coordination of cloud networking, wireless communication, to give the client remote control of different lights, fans, and appliances inside their home and putting away the information in the cloud is displayed. In this paper, system is intended to be minimal effort and expandable permitting an assortment of devices to be controlled. Intel Galileo associates with the web through WiFi. Cloud computing utilized as remote servers on the web to oversee, store and process information as opposed to utilizing a personal computer [9].

This paper proposes a platform to deal with the integration and behavior-aware organization of heterogeneous devices as services, put away and got to by means of the cloud. A novel cloud-based IoT platform of behavior-aware devices as services for surrounding insight frameworks, approving the entire approach in genuine situations identified with a particular encompassing helped living application is actualized and produced. In this paper systems in light of cloud computing innovation, interfacing the entryway accountable for getting the information from the devices with a cloud platform, to remotely get to and screens the information at run-time and respond to crisis circumstances is composed [10].

## PROPOSED ARCHITECTURE

The system is derived from the idea of IoT. Initially the Arduino board connects to the internet through WiFi. The Arduino digital board consists of Arduino Nano board and logic gates. The user can give input to the Arduino board through the internet via web server. The user inputs are sent to the web server and stored in the cloud. In cloud computing, software as a service is used. Software as a service enables customers to use an application on demand via a browser. The proposed module consist two parts 1. Basic circuit verification, 2. Building Complex Digital circuits and verification (by use of Boolean expressions).

## BLOCK DIAGRAM

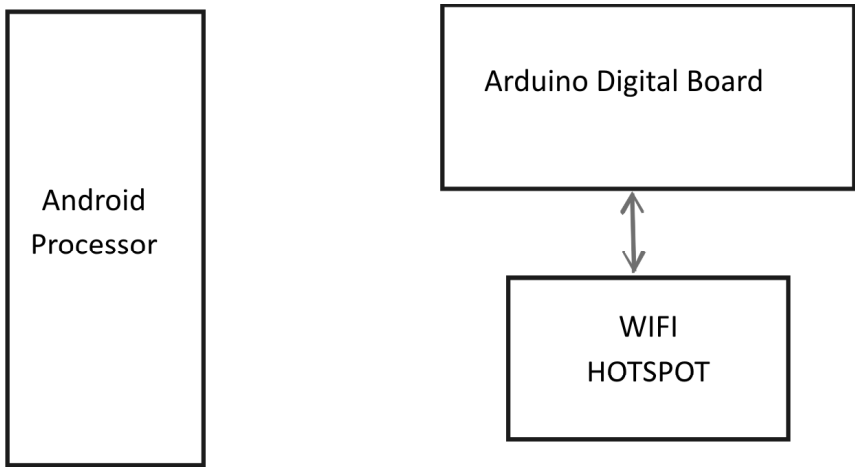



**Figure 1: Block Diagram of proposed system**

## PROPOSED SYSTEM ARCHITECTURE

### Cloud based server

This is web entity that stores the data from the user and then transfer input data to the Arduino board. The system allows user to verify the outputs.

### Arduino Digital Board

The Arduino Digital board consists of Arduino Nano board and the following atomic library circuits:

1. And Gate
2. Nand Gate
3. OR Gate
4. NOT Gate
5. XOR Gate
6. RS flip flop using Nand Gate

### Arduino Nano Board

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 or ATmega168. The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. This is used as a control unit. The Arduino module connects with the cloud server through an Internet connection to transfer data from the local car park to the cloud server database.More complex circuits are dynamically built using these basic library gates with the interconnection part taken care by the Arduino board.

### WIFI Hotspot

The WIFI Hotspot is provided by the WIFI Module that is connected to the Arduino board.

## Implementation

There are two process parts available in proposed system design. They are described below

### *(a) Circuit Verification*

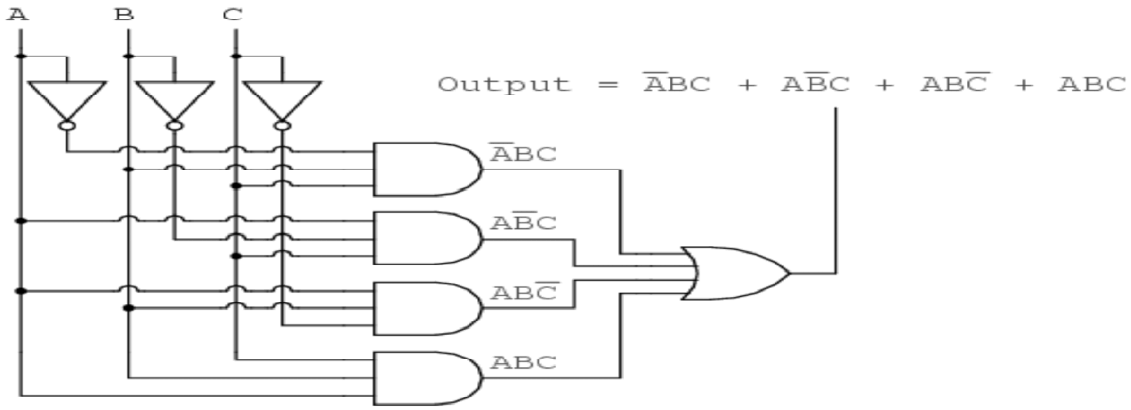
The App provides the following options for verification of library circuits:

1. AND Gate
2. OR Gate
3. NOT Gate
4. NAND Gate
5. XOR Gate
6. Half Adder
7. Full Adder
8. RS Flip Flop
9. 2:1 Multiplexer

### *(b) Circuit Emulation and Verification*

The App also provides for emulating Maximum of 5 Input Digital circuit by providing the Boolean expression.The App sends this data to the Arduino board through WIFI channel and the Arduino board dynamically constructs this circuit using the basic logic gates connected to it and inputs could be provided through the App and the outputs could be verified.

For Example consider the following Circuit:




In the App the Expression A'BC + AB'C + ABC' + ABC needs to be provided.

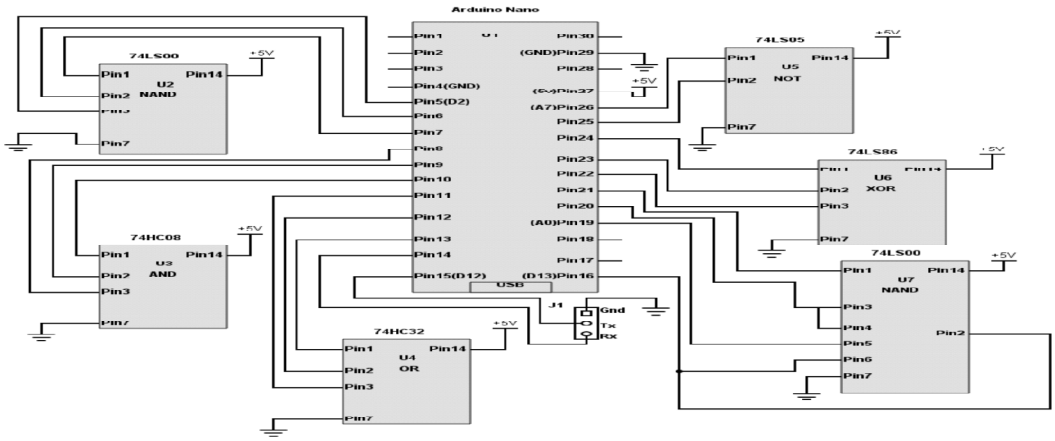
The Arduino does the following tasks:

1. First logically constructs the circuit using this expression
2. Then when the user provides various inputs for A, B and C, it evaluates this expression based on the inputs provided by the user for A, B and C and provides the output to the App that is displayed to the user.

## Method to Conduct Digital Lab

1. Switch on the WIFI Module and the Arduino Digital Circuit board.
2. Select the "WIFILAB" Access point on your Android Mobile Phone.
3. Once Connected, Start the WIFILAB App.
4. The App starts by displaying MGR Logo and a button "Start"
5. Click on "Start"
6. Select "Verification" in the Next Screen
7. Select the Experiment from the List
8. Provide Inputs and click on Evaluate button to see the output
9. In case of Circuit Emulation, select "Circuit Emulation" instead of "Verification"
10. Provide the Boolean Equation in the "Equation" Text box and click on "Build Circuit"
11. Provide Inputs in the screen and click on evaluate to see the output of the Equation.

## Circuit Diagram of Arduino Digital Board




## Some of the App Screen Shots

**Initial Screen:**


**Output Screen:**

## CONCLUSION

The platform is designed to be accessible to a wide range of students and easily adapted for other applications.This paper present a lab kit platform based on an Arduino microcontroller board and open hardware that enables students to use low-cost, course specific hardware to complete lab exercises at anywhere. This WiFi enabled IoT allows users to be modify inputs with the platform, and the platform enables new exercises that would not be possible in a traditional lab. The platform delivers a consistent, high quality laboratory experience for both on-campus and remote student is designed in this paper. This paper presents a model for testing this relative effectiveness, and discusses the results of a preliminary assessment of wifi enabled IoTs.

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