Computer Laboratory Automation Using Internet of Things

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Abstract
Internet of Things (IOT) is a platform for automating user activities in the society with the help of machines. It brings ordinary change in our professional as well as personal life. Today, IOT is being executed everywhere which is of human concern like smart city, smart environment, security, smart agriculture, home automation, etc. In this paper, an idea of automating Computer Laboratory is being proposed. Automating will be controlling lights, fans, computer systems available in the laboratory. An android app will monitor all these things remotely using Internet.

IndexTerms **-**Internet of Things, smart city, smart environment, security, smart business process, smart agriculture, home automation, healthcare

I INTRODUCTION

The Internet of things is interconnecting of vehicles, buildings and many other physical objects embedded with software, sensors, electronics, actuators and network. It allows these objects to collect and exchange data. Collecting and analyzing data gives you rapid understanding into trends, so that you can modify your production activity. With IOT, you can spend less time speculating and more time on taking action.
IOT is nothing but connecting your daily life objects (things) with the Internet using embedded systems along with different sensors like IR Sensor, DHT Sensor, LDR Sensor, etc. for monitor various real-life activities. Data is being collected from these sensors & analyzed for further operations. IOT is the combination software, hardware & internet. IOT allows objects to be sensed and/or controlled remotely across existing network infrastructure.

Fig. 1. Internet of Things [1]

II LITERATURE SURVEY

2.1 Home Automation

The system proposed in [2] explains controlling and automation of lighting, heating, ventilation, air conditioning and security, as well as home appliances such as washer or dryers, ovens or refrigerators. Now a day, this application is spreading very vastly among developed as well as developing countries like India. Such application reduces human work and ultimately energy too. Different home appliances can be monitored remotely from anywhere with the help of various mobile application & Internet.

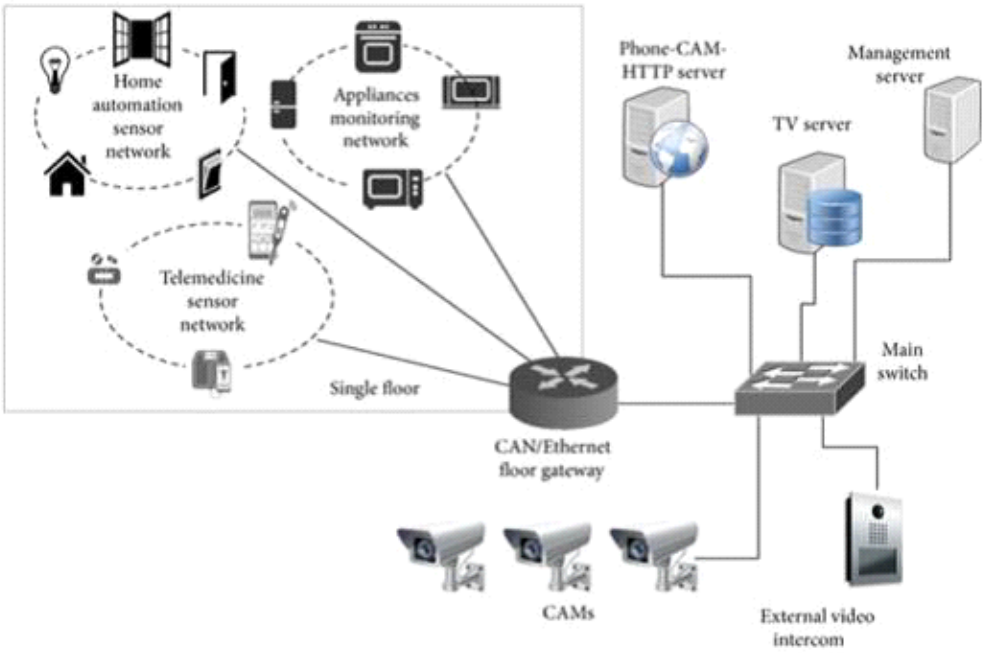

Fig. 2. Home Automation

This system is primarily developed by sensors, controlling devices and different actuators. The sensors detect light, motion, temperature & other sensing elements, and then sends that data to the various controlling devices. These sensors can be thermocouples or thermistors, photo detectors, level sensors, pressure sensors, current transformers, IR sensors, etc., which need an additional signal conditioning equipment to communicate with the main controller.

2.2 Wireless Control Systems

Similarly, the system using wireless communication proposed in [3] can be made by linking up stand-alone appliances that are present at home or in office and integrating to form a cooperating network. A combination of various technologies like Wi-Fi and Bluetooth are used to integrate the system. Such a system is laid out as illustrated in figure 3 and 4. The universal plug and play capability is used to provide a transparent network of devices to the us er. The system makes use of the Open Service Gateway Interface (OSGi). [3]

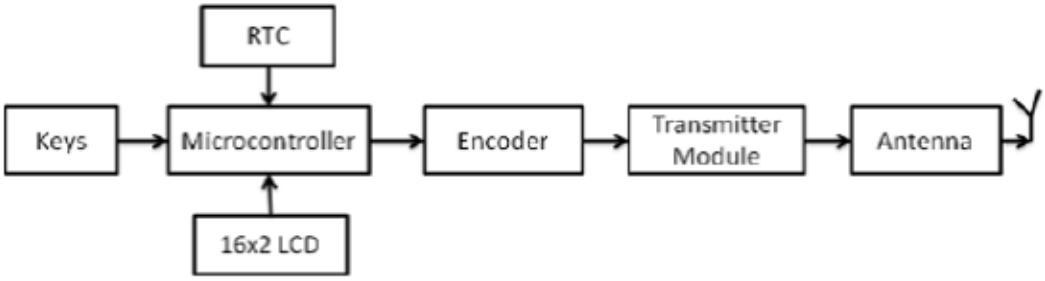

Fig. 3. Block Diagram of Transmitter Sect ion

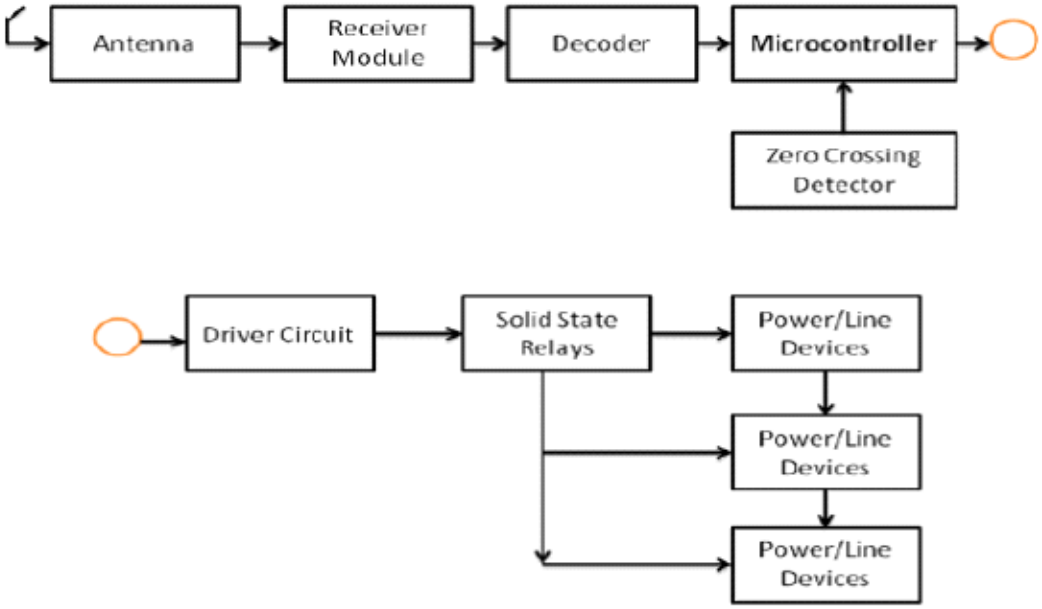

Fig. 4. Block Diagram of Receiver Sect ion

2.3 GSM Based Home Automation System

The system proposed in [4] develops developing a system, which uses technology that keeps control of the various units of the automobiles, which executes with respect to the signal sent to the mobile. As we have the new concept has been thought to manage them remotely by using a GSM, which enables the user remotely control switching off appliances. By simply sending SMS to the modem at the remote place, the devices can be turned ON/OFF and the status of the device can be sent to the registered mobile number programmed in the microcontroller.

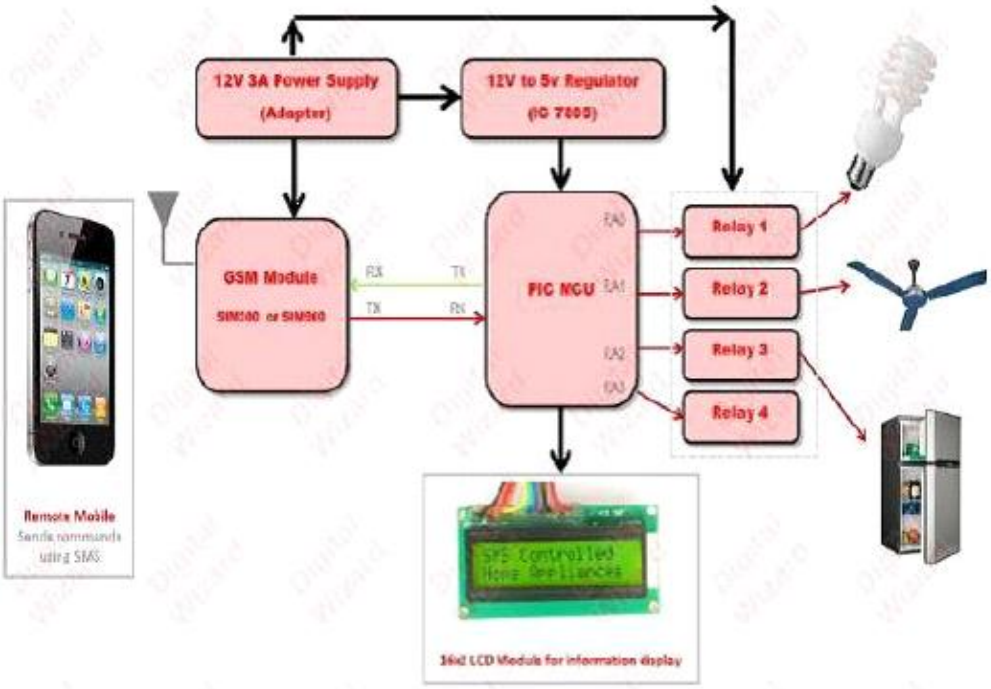

Fig. 5. GSM Based Home Automation System

2.4 Android Based Home Automation Using Bluetooth

Another system proposed in [5] describes two modes of operation viz. Automatic and Manual. In automatic mode, the speed of fan is adjusted according to the measured value of temperature. Bulb is turned ON or OFF according to intensity of light available in the room. Normally, before commencing communication, devices can use two methods for initiating communication with each other which can be done normally either by discovering other nearby devices to detect the address and services that are provided by other devices or by knowing the device address beforehand and directly using that address for further communication process. In Home Appliance Control, later method is used.

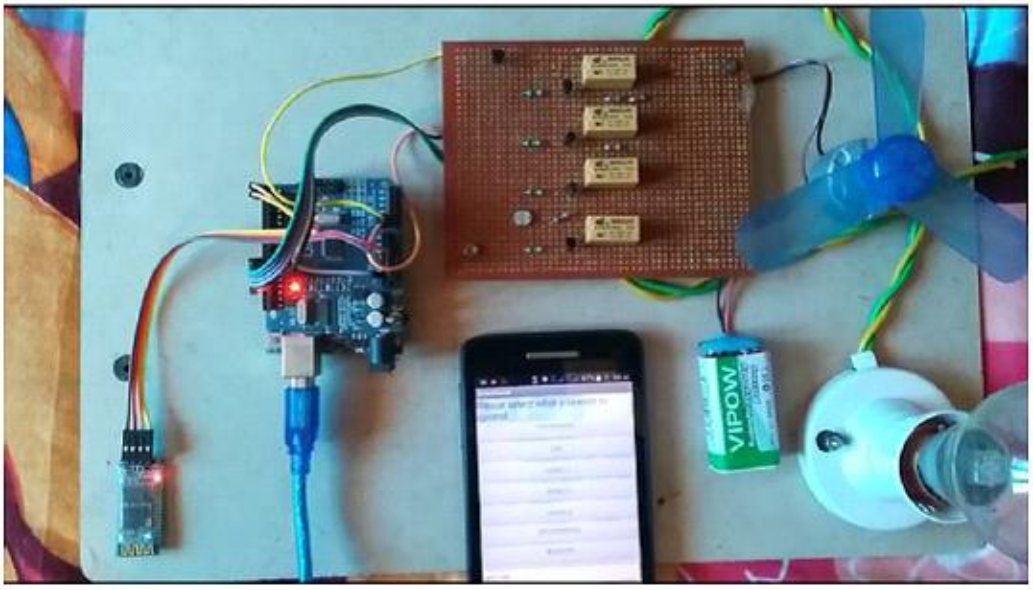

Fig. 6. Android Based Home Automation Using Bluetooth

While in manual mode, speed can be adjusted using the android application in the android phone. Conventional way means traditionally all the devices are controlled using the android app through Bluetooth module. Any user wants to make device ON/OFF without using HAS then he/she can use particular switch attached to device.

III PROPOSED SYSTEM

3.1 System Architecture

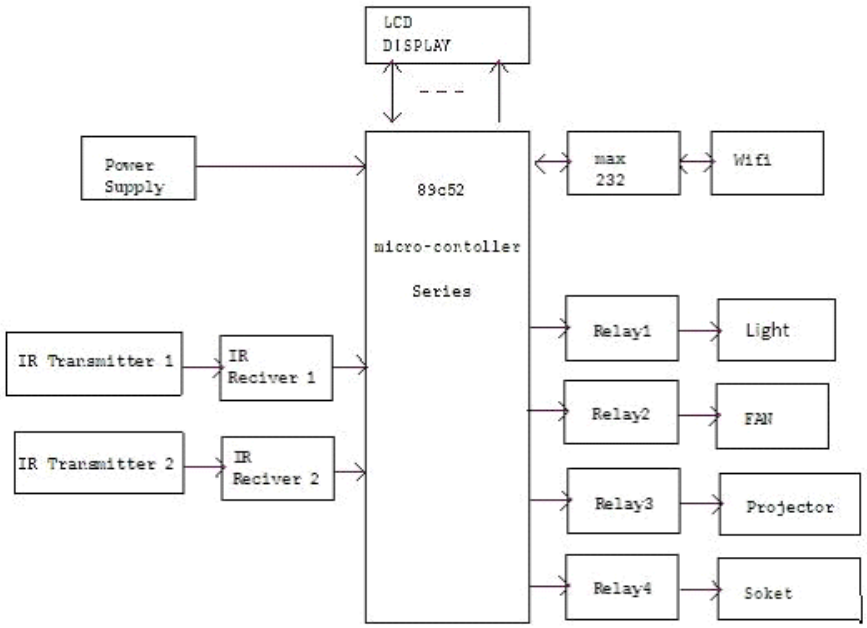

Fig. 7. System Architecture

Automation of Computer Laboratory system is designed by focusing on any kind of laboratory in any school or college. Generally, laboratory may consist of lights, fans, computer systems, printer, projector, etc. In that case, it is necessary to monitor the laboratory when it is not in use or when it is in less use. Automation of laboratory is mainly controlling all the electronic components in the lab remotely with the help of mobile application installed on any smartphone. This will help in saving the electricity. In order to implement the proposed system, following hardware components are required,

- IR Sensor
- DHT 11 Sensor
- Relay Switch
- LCD Display
- Wi-Fi Module

IR Sensor: IR Proximity Sensor are used to detect objects and obstacles coming in front of them. Sensor keeps transmitting modulated infrared light. When any object comes near, it is detected by the sensor by monitoring the reflected light from the object. As soon as any obstacle will by detect by IR Receiver, Obstacle LED will glow.

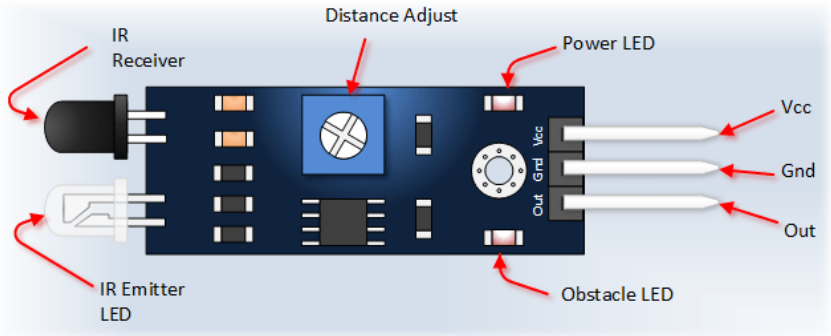

Fig. 8. IR Sensor [6]

DHT 11 Sensor: The DHT11 is a basic, low cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed). It is fairly simple to use but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old. [7]

Fig. 9. DHT11 Sensor [8]

Relay Switch: The relay switch is an electrically functioned switch which allows turn on or off device using any circuit. It works on voltage and/or current which is much higher than a micro controller. Relay guards each circuit from each other & operates on small amount of power. Heart of any relay is an electromagnet. Electromagnet is a coil of wire that becomes temporary magnet when electricity flows through it.

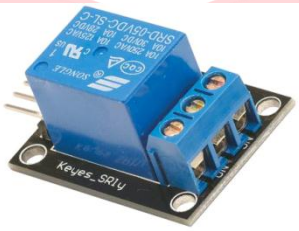

Fig. 10. Relay Switch [9]

Wi-Fi Module: Espressif Systems' Smart Connectivity Platform (ESCP) is a set of high performance, high integration wireless SOCs which is designed for space and power controlled mobile platform designers. It offers supreme ability to function as standalone application along with requirement of minimum cost as well as minimum space. ESP provides a complete and self-contained Wi-Fi networking solution.

Fig. 11. ESP8266EX Wi-Fi Module [10]

LCD Display: Liquid Crystal Display screen is an electronic display module used to display some data or message for user. A 16x2 LCD display is very basic module in which 16 represents 16 characters per line in 2 lines. In this LCD, each character is presented in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to LCD. The data register stores data to be displayed on LCD.

DISPLAY CHARACTER ADDRESS CODE:

Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM Address	00	01														0F
DD RAM Address	40	41														4F

Fig. 12. LCD Display

3.2 System Implementation

Different methodologies have been proposed for implementing proposed Computer Laboratory Automation System Based on Internet of Things. These are,

IR Sensor Based Automation: Some systems are described as an enabling system that can be used to provide a common framework for computer lab Automation. It provides a system for a smart computer lab that includes facilities such as a system controller lick light and fan. This will enable using the existing system for computer lab automation.

The function of this remote controller is to control the power supplied to devices at a remote location. The controller is a logic system built entirely of hardware. It eliminates the cost incurred with micro controllers. It uses a transceiver which is interfaced with a solid-state relay to control the power supply. It could also be implemented experimentally with infrared signals and AC power line carrier technology.

Algorithm:

- Initially, laboratory is empty. All the lights, fans, computer system, printer, projector, scanner, etc. are turned off.
- Users (students, staff and/or faculty) start entering into the laboratory.
- If the count of number of users in the laboratory reaches upto the threshold value (predefined), the lights will be turn on automatically.
- Similarly, if the room temperature reaches upto the threshold value (also predefined), the fan will also get turn on automatically.
- If user is not working with its computer system, then that system will go in either standby mode or it will be shut down.
- If users start leaving the laboratory & count of numbers of users present in the laboratory reduces below threshold value, then lights will turn off automatically.
- Similarly, if the room temperature reduces below the threshold value, the fan will also get turn off automatically.

Modules: The proposed system is automating laboratory in college. Based on this, the system is divided in different modules. These modules are,

- Monitoring Lights & Fans
- Monitoring Computers & other IT components
- Mobile Application for Monitoring & Observing

Central component which is consider while implementing these modules is the user. The user can be anyone either students, staff or faculty who are functioning in that laboratory. Along with automation, the manual system for monitoring above modules will also be provided & will be used whenever it will be required. Manual system will be used in different situations like during cleaning, while maintenance, etc.

Monitoring Lights & Fans

As stated earlier, the central functioning component in this system will be the user. So, to monitor all the lights & fans in the laboratory, the presence or absence of the user needs to consider. The threshold value for number of users present in the laboratory should be constant. The automation will be depending on this threshold value as shown in fig. 11.

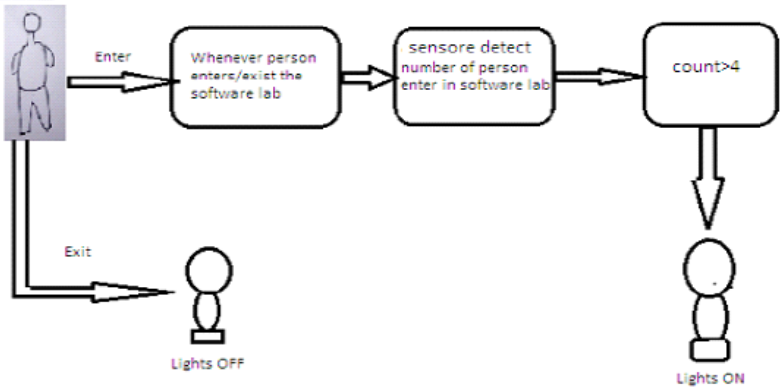

Fig. 13. Controlling Lights & Fans

Monitoring Computers & other IT components

This module focuses on various IT infrastructures like computer system, printer, projector, scanner, etc. If the user is present in the laboratory, then only that respective computer system & other IT components should remain on, remaining components should be turned off. In another case, the computer system will automatically go into the standby mode if the user won't work on that system for continuous 10 minutes. Before that, all the data will be saved to prevent loss of existing work. Other components like printer, scanner, projector will be automated partially. There will be manual process for turning them on but they will be auto turned off when not in use.

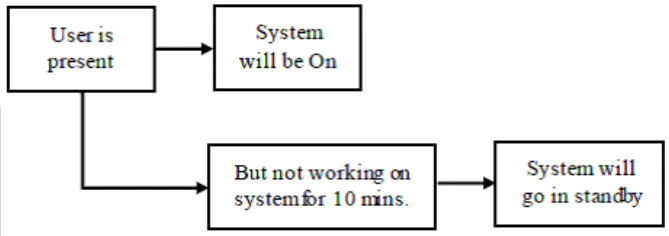

Fig. 14. Controlling Computers & Other IT components

Mobile Application

There will be an android mobile application with the concern person of computer laboratory who can observe & monitor this automation system. The presence or absence of the users will be observed on the app with the help of live data received through IR sensor, Internet and Wi-Fi module mounted in the laboratory. Accordingly, this app will display the notification related to current state of all lights & fans. The facility of turning on or off the lights & fans will be provided in this app. Due to this, user may monitor it remotely through Internet. The app will contain the layout of the laboratory which mainly includes the location of computers, printer, scanner, projector, etc.

Fig. 15. Laboratory Automation Based on IOT

The presence or absence of user in the laboratory will be detected with the help of IR sensor. As shown in figure 8, IR sensor will detect the obstacle with the help of IR Emitter & IR Receiver. When user enters the computer laboratory, sensor will start counting the number of person. If that count reaches upto the threshold value, then all the lights in the laboratory will automatically get turned on otherwise they will remain off. Similarly, DHT11 Sensor, shown in figure 10, will detect room temperature. If the room temperature will cross the threshold value, then only the fans in the laboratory will be turned on. The relay switch, shown in figure 6, will be used for automatically turning on or off the lights and fans. Along with automation of lights & fans, manual process is also

provided for some situation like maintenance or cleaning of the laboratory. This manual system will be least focused in the proposed system.

It will also be notified on the app whether any computer system is currently turned on or off. To monitor all these activities, the continuous Wireless Internet connectivity should be required in the laboratory as well as on the mobile phone on which this app is going to be installed.

CONCLUSION

Today, IOT has numerous applications like Smart City, Smart Environment, Security, Smart Business Process, Smart Agriculture, Home Automation, Healthcare and many more. So, it is necessary to adopt this technology to simplify our personal as well as professional lifestyle. By considering this, it has been decided to automate the computer laboratory in the college. All the hardware components in the laboratory will be automated depending upon the presence or absence of the user. This will help to save the electricity as well as the functioning time. Also, the manual work of monitoring of the laboratory will be reduced.

REFERENCES

[1] https://cdn.business2community.com/#4Po5CZUSxQSmKv8W.97
[2] Susanna Spinsante, Ennio Gambi, "NFC – Based User Interface for Smart Environment", Volume 2015, Article ID 854671, Advances in Human-Computer Interaction, 12 pages.
[3] Satish Palaniappan, Naveen Hariharan, Naren T Kesh, Vidhyalakshimi S, Angel Deborah S, "Home Automation Systems - A Study", International Journal of Computer Applications, Volume 116 – No. 11, April 2015, pp. 11-18
[4] Gaikwad Mrudula Bhaskar, Lohakare Shraddha Sanjay, Patil Ritesh Anil, Varade Amol Sopan, "GSM BASED HOME AUTOMATION SYSTEM", International Conference on Recent Trends in Civil Engineering, Science and Management, ISBN: 978-93-86171-34-4, pp. 244-248
[5] Harikrishnan. D, Nikhil. S, Midhin Thomas Roy, Sera V Mathew, "Android Based Home Automation Using Bluetooth", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 4, April 2017, pp. 2605-2609
[6]https://i1.wp.com/henrysbench.capnfatz.com/wp-content/upload/2015/06/Arduino-IR-Collision-Detection-Module-Pin-Outs.png? fit=648%2C270
[7] https://www.adafruit.com/product/386
[8] https://i.ebayimg.com/images/g/AfsAAOxy63FSw6h1/s-l300.jpg
[9] https://www.parallax.com/sites/default/files/styles/full-size-product/ public/27115a.png?itok=rf7_zs6J
[10] Espressif Systems, "Espressif Smart Connectivity Platform: ESP8266EX", 2014

