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Design and Implementation of Smart Room

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Abstract: ***Our modern life today is simply over dependent on technology and its application. The cornerstone of such development in industrial and commercial sectors of our life is the automation process as a field of modern technology. This paper concerns on commercial residential application of automation technique to design and implement advanced conventional room known as smart room using Arduino UNO as the main microcontroller board .Smart room incorporates room appliances control automation wirelessly using HC-05 Bluetooth module and android application; automatic security alarm system involving buzzer; and a real time weather status display via 16x2 LCD using DHT11 sensor. The user controls all room appliances and also display temperature and humidly status on the LCD by sending numerical character from his Smartphone Bluetooth terminal to the microcontroller wirelessly, furthermore the security system works automatically upon detecting an intruder.***

Keywords: Arduino Uno, LCD, Smart phone, HC-05 Bluetooth module, Sensor

I. INTRODUCTION

Room appliances Automation; security of our rooms; and whether status information; remain vital to our daily day-to-day activities. Elderly and handicapped people find it tedious or are not able to move frequently for controlling room appliances such as: fans, bulbs, television etc. Intruders and thieves continue to invade our rooms, unknowingly to us and as a result we lost our properties, belongings and peaceful mind of a secured room when we are outside our rooms. Similarly, we often look through our windows each morning to understand the weather status which would enable us to know the cloth we will wear, where shall we visit and what we will do over the day etc. With the advancement of technology and our over dependence on our smart mobile phones, The smart room technology will be a much needed extension of our conventional rooms to contains all needs mentioned and to cater for many problem that do affect our residence. Over the years different technologies have evolved for smart room technology implementation among which are: Bluetooth, WIFI and ZigBee for communication purposes and different devices such as: smart phones, laptops etc controlling various appliances. This paper designs and implements smart room using Bluetooth technology and is economically low cost for easier implementation.

II. LITERARUTE REVIEW

In [1] the research paper designs and implement smart home, it consists of an android application which would send control signal via ESP8266 WIFI module to an Arduino microcontroller for automating and controlling of accessories using relay board. [2] The paper presented home automation system (HAS).

Bluetooth HC-05 module was used to establish the communication purposes. Android Application sends signal or voice command to Arduino to control up to four appliances using 4-channel relay board. [3], the paper employs IOT technology; it implemented home automation and home security technique. ESP8268 WIFI module and other sensors are interface with Arduino, the sensors read the condition of the home appliances and upload it to a cloud platform so that user can access it. The microcontroller provided the control.

[4] Home automation and security ware discussed and implemented using GSM module, Arduino and Android application. A counter displays the number of people entering the home on LCD, in automation mode, appliances are turned on/off depends upon if a person is available in the home while in security mode, light and an alarm are turned and SMS message alert is sent upon detecting intruder. Similarly, Smartphone application can be use by residence for appliances automation. [5] Home Automation of appliances cantered on Arduino UNO as the main controller was designed and implemented, features include water level indication using ultrasonic detector and plant irrigation system monitoring using soil moisture detector was used. Bluetooth module HC-06 was used.

[6] The author demonstrated home automation of appliances over the internet as channel of communication. It employs raspberry microcontroller as a server and upon receiving control signal from Smartphone application from any place, it activates the operation of relay to an appliance.

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III. PROPOSED DESIGN

From the literature review above, most of the design concern only about automation of appliances in homes and employs WIFI module which relatively is cost high and difficult in implementation, require expertise to handle and monitor, and problem of network connectivity would always remain a setback. The design here gives expansion upon automation of appliances to add intelligent security system and real time weather status in a room and it involves Bluetooth which is easier in implementation than WIFI module and better cost economic.

The figure below shows the block diagram of Smart Room Technology:

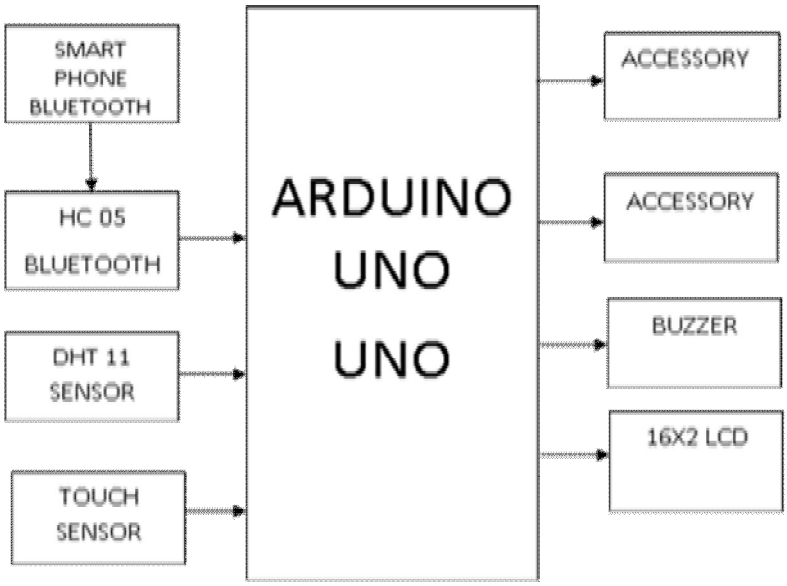


Figure 1: Block Diagram of Smart Room

IV. COMPONENTS AND SPECIFICATIONS

A. *Hardware Used*

1) *Arduino Uno Board:* This is an open source general purpose microcontroller board based on ATMEGA 328 Microcontroller. The board has 14 digital input/output pins, six analog inputs pins, programmable using Arduino UNO IDE and can be powered through USB port or External 7v to 20v power adaptor. The board however can be used in extension with other boards for some applications. The board has other technical specification and other pins of different application.



Figure 2: Arduino Uno

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2) *Hc-05 Bluetooth Module:* This is manufactured for wireless communication, it is based on IEEE8802.15.1 standard protocol, through which one can build wireless personal area network. It uses frequency-hopping spread spectrum radio technology to send data. This module can be used in a master and slave configuration. It has 6 pins: Key/EN ;VCC ;GND ;TXD ;RXD and STATE. Similarly, the module has RED LED to show connection status, before user device is connected, the light blinks fast and continuously, after the device is connected it slows down to blink slowly. HC 05 operates on 3.3V voltage supply but can work with 5V supply since it has in-build voltage regulator. Default baud rate is 38400bps.

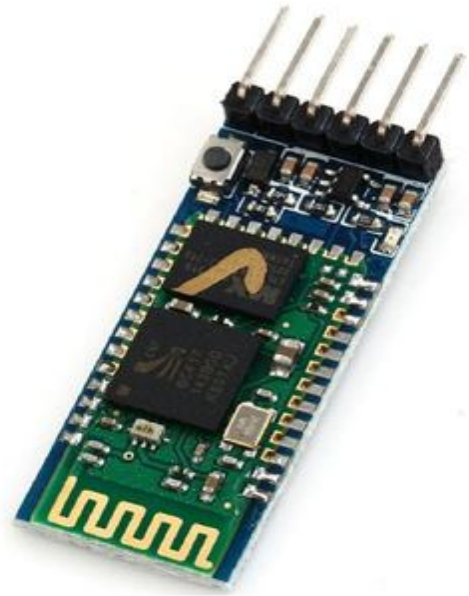


Figure 3: HC-05 Bluetooth module

3) *16x2 LCD:* Liquid crystal display (LCD) is very popular in embedded and IOT projects because of its cheapness, availability and easily to be programmed for display of an image or characters on its flat screen. LCD does not produce their own light rather depends on some reflectors to produce image in a single color. It is named 16x2 because it has 16 columns and 2 rows meaning it can contain 16*2=32 images or characters in total and each is made of 5x8 pixel dots.

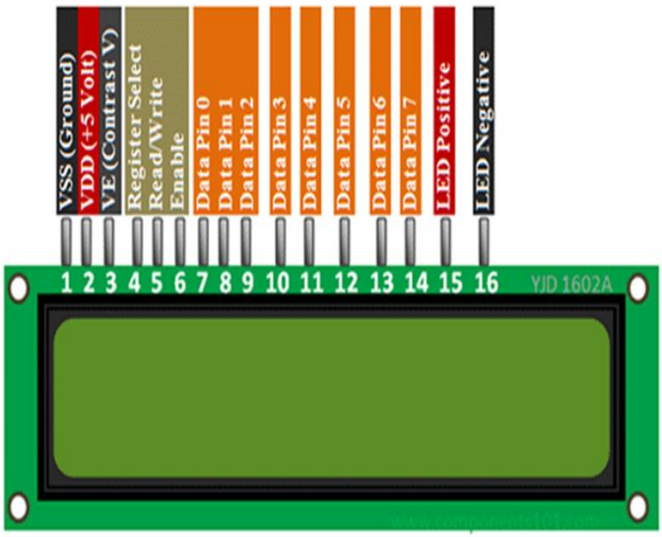


Figure 4: 16x2 LCD Pin Descriptions and Specification[7]

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4) *DHT11* Sensor: This consists mainly of resistive humidity measurement component and negative temperature coefficient component. It is a single wire humidity and temperature detector that produce fully calibrated digital humidity and temperature values output serially with a single wire protocol. The sensor is manufactured in a single row of 3 0r 4 pins package and operates from 3.5v to 5.5v supply. It measures temperature range of 0-50^{0}C with an accuracy of +2^{0}C% and humidity ranging from 20-90% with an accuracy of 5%.



Figure 5: DHT11 Sensor

5) *Touch Sensor:* Also known as tactile sensor, it is mostly a proximity sensor reduced to lowest distance. Touch sensors are used to detect and sense touch, they operate as a closed switch upon touched. They perform action similar to human being's skin.

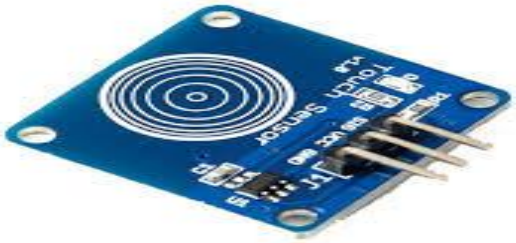


Figure 6: Touch sensor

6) *Relay Module:* This is designed for mostly microcontroller such as Arduino UNO board, PIC, etc. Relay is an electrically operated switch that is used to control or operate both AC and DC output devices upon receiving a pulse signal. A channel relay module has six pins: VCC (+5V), GND, Digital input, normally closed and normally open. The relay output is always connected to normally closed pin, upon receiving pulse it got triggered to normally open.



Figure 7: relay module

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V. SOFTWARE ARCHITECTURE

The microcontroller was programmed in an open source ARDUINO UNO IDE, the programmed was written as a sketch and uploaded to the Arduino UNO board. The detail algorithm is below:

A. Automation and Weather status Display Algorithms

1) *Input:* Character "KEY" from android application
2) *Output:* Status of pin
a) Initialize input and output pins
b) If serial available, read and store it in to variable "KEY"
c) Switch "KEY"
d) Case "1": switch ON first accessory
e) Case"2": switch OFF first accessory
f) Case"3": switch ON second accessory
g) Case"4": switch OFF second accessory
h) Case"0": display weather status information on LCD
i) End

B. Automatic security Program Algorithms

1) *Input:* character "INPUTVAL" from android application
2) *Output:* status of pin
a) Initialize input and output pins
b) Declare character ALARM VALUE
c) Analog read input quantity and stores in "INPUTVAL"
d) If INPUTVAL is greater than ALARMVALUE, Set output pin HIGH
e) If INPUTVAL is less than ALARMVALUE, Set output pin LOW
f) Repeat continuously

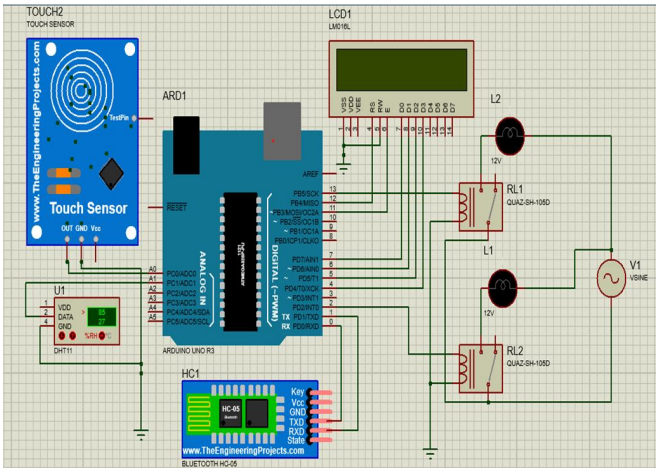


Figure 8: Circuit Diagram

VI. RESULTS

The proposed plan of this paper leads to its real implementation and all the goals required of the smart room was observed and tested. Excellent communication between our smart phone android application and Arduino UNO was obtained first, the accessories were then fully controlled independently and simultaneously by sending the right numerical command also the LCD displayed the real time weather status information on the LCD by sending the appropriate command. Finally, the security system was tested, the touch sensor was touched and buzzer alarm sound was heard. The system is very important for Room residence, economic friendly and easily implemented.

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VII. CONCLUSION

Smart room is an advance extension of commercial room to make life very comport for its residence. In the paper, design of smart room was discussed along with a block diagram and all hardware and software ware discussed appropriately. The system was also implemented and tested and it comprises of room accessories automation, security system and real time weather status display. The Bluetooth module provides the communication channel between the smart phone application and Arduino UNO microcontroller. The project demonstrated the high objective of energy saving needs, cost effectiveness and easily programmed, implemented and maintained.

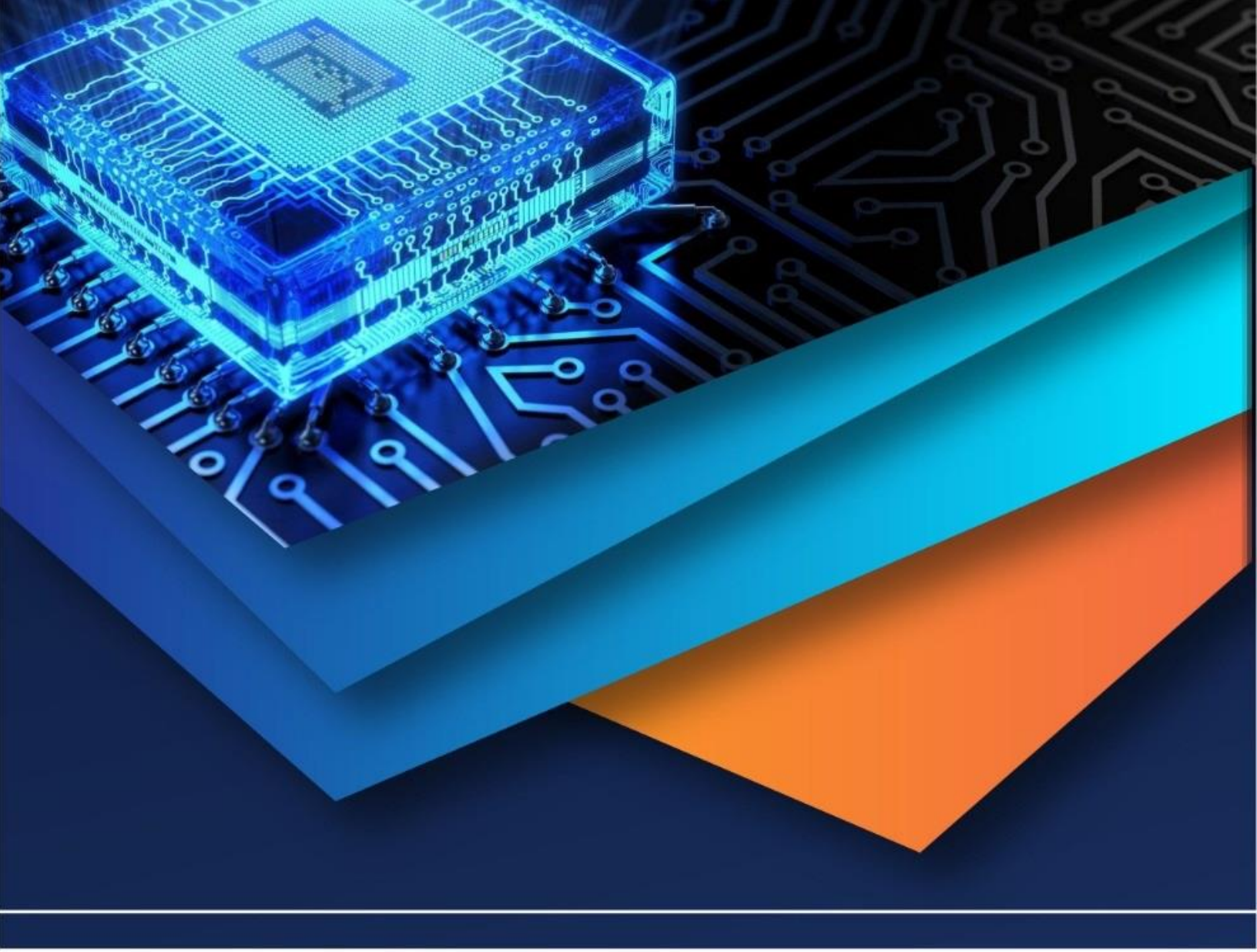
VIII. ACKNOWLEDGMENT

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