

# Implementation of Digital Circuits using the Internet of Things

Nikhil Sahukar<sup>1</sup>, Ponuku Krupa Sirisha<sup>2</sup>, Konathala Vnss Ravi Vikas<sup>3</sup>

<sup>1,2,3</sup>Student, EECE Department, Gitam University, Visakhapatnam, Andhra Pradesh

## ABSTRACT

Digital circuits are used everywhere in day to day lives. There is a need to learn it practically by every undergraduate in laboratories. Digital trainer kits are being used in laboratories which use a basic circuit connection approach. Only this approach is not sufficient for a student to explore deep enough because digital circuits can be implemented by any number of approaches. A smart approach is required for enhancement of the trainer kit. This project incorporates the Iot approach required for implementation of digital circuits. This project works as a digital demo kit which helps students to smartly learn boolean functions with the Iot approach. Arduino microcontroller is a substitute for digital circuits and it brings smartness and digital logic in one platform to easily achieve the required digital functionality. In this project, implementation of logic gates, basic combinational and sequential circuits will be done. This project uses Arduino programming which is executed with respect to digital circuits. The inputs are given using ultrasonic sensors, input parameters are given efficiently using the bluetooth module and the outputs will be shown on a two bit seven segment display. Trainer kits can be fabricated using this mechanism and components and thus, it would definitely find a good application in laboratories helping undergraduates to learn in a better manner.

**Keywords:** Digital circuits, Arduino, digital logic, bluetooth, display.

## 1. INTRODUCTION

Logic Gates are the building blocks of digital logic design. The arrangement of these gates in various models provides solutions in an appropriate manner to the complex problems. Nevertheless, there are challenges which pose a threat to digital circuits [1]. A part of a digital integrated circuit may misbehave due to thermal effects i.e. it may burn resulting in the failure of IC [2]. So, the replacement of the failed part is a challenge. It is not easily available in the market. Hence, there is a need to reproduce the functionality of the failed part using circuit diagrams and experience [3]. This replacement can be done using flexible components like Arduino. The present work focuses on replacing the logic gate integrated circuits with programmed Arduino with desired functionality.

## 2. RELATED WORK

Since digital trainer kits are already in use for many years, this work is an upgrade or an innovative version of it based on the emerging technologies. The desired digital functions are given using a bluetooth controller app installed in mobile. Arduino knows via bluetooth connection what digital function to implement. And based on the provided inputs it runs and displays the output on the seven

segment display. Here, ultrasonic sensors are used to know what inputs are provided for the digital circuit.

### 3. MATERIALS

In this work, components like Arduino Uno board, ultrasonic sensors, one and two bit seven segment displays were used along with bluetooth module and jumper wires supported by cardboard sheets providing a platform for the connection of these components.

### 4. EXPERIMENTAL RESULTS AND DISCUSSION

The bluetooth controller app is installed on mobile to command the Arduino which digital function to be implemented. The input is given to the bluetooth module which is connected to Arduino. The Arduino receives the desired digital function which is to be implemented.

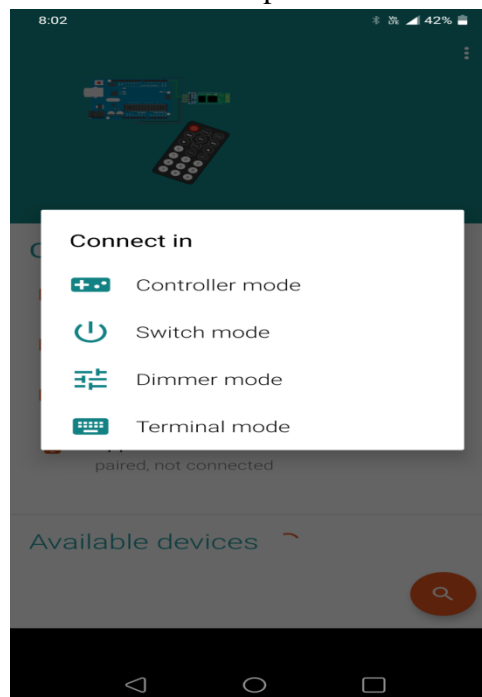


Fig 4.1 Setting Mode in bluetooth app

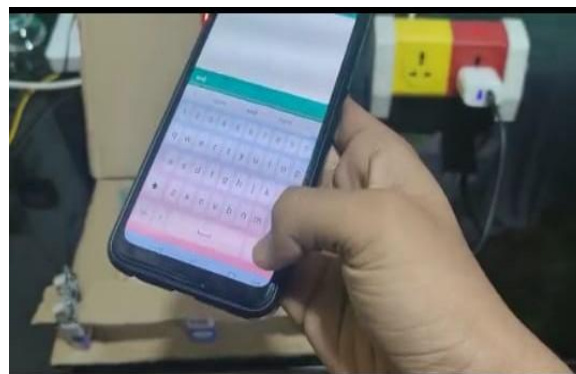


Fig 4.2 Digital function given as input

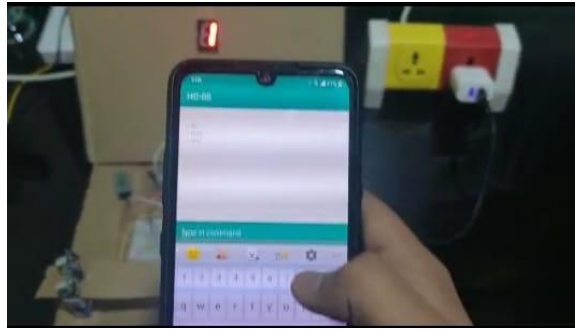


Fig 4.3 Outputs change as per the function

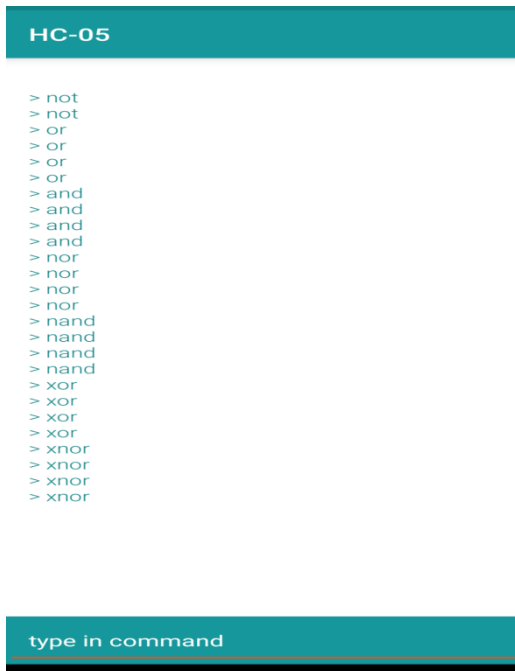


Fig 4.4 Digital logic function to be given using bluetooth

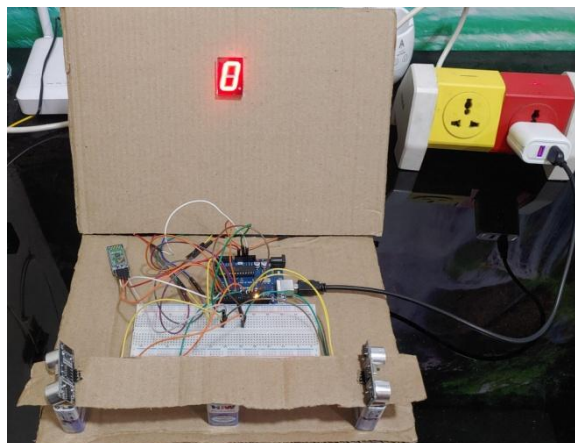


Fig 4.5 Display of input '0' for input '00'

The Arduino program is compiled and runned in Arduino software and then uploaded to the Arduino board. If an object is present in front of the sensor, the input is considered '1' otherwise it's considered '0'. Left sensor detects the first bit (MSB) and the right sensor detects the second bit (LSB). Based on

the provided inputs through bluetooth connection and sensors, the program is executed and the output is shown on the display.

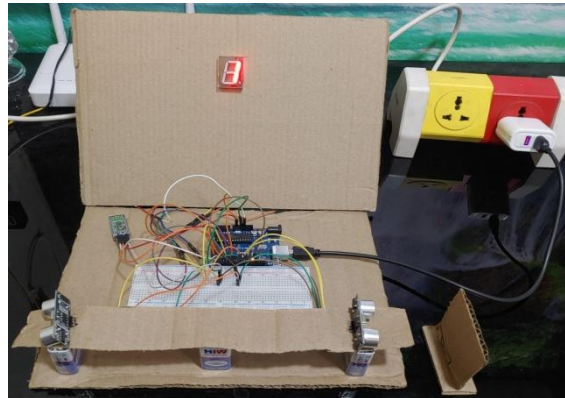


Fig 4.6 Display of input '1' for input '01'

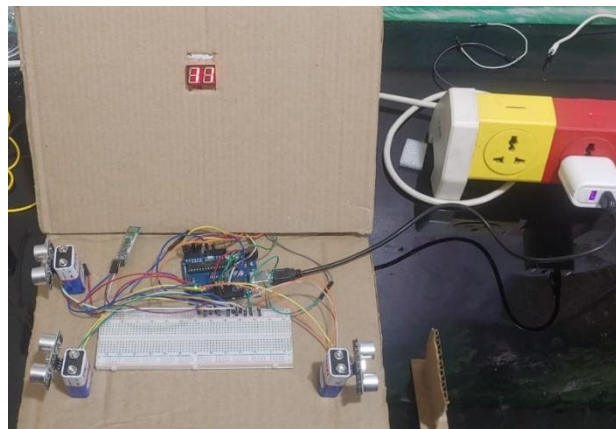


Fig 4.7 Display of input '11' for input '010'

Various digital logic functions have been implemented such as the seven logic gates and combinational circuits as of now.

## 5. CONCLUSION

In this project, it would be concluded that an embedded system can be used as a digital circuit. Implementation of digital functions in a smart approach can only be done by an embedded system comprising sensors. In spite of being not an application oriented project, the mechanism is almost similar to that of an application oriented project. There would only be a slight change in outputs. In this project, the outputs are nothing but digital numbers '0' and '1' whereas the outputs can be like rotating a motor or switching lights for an application oriented project. This project will be applicable in an indirect manner through the use of the mechanism or software program.

## 6. ACKNOWLEDGEMENT

We would like to thank Assistant Professor Dr.G.Anitha and Associate Professor Dr.K.Sridevi for guiding and providing necessary resources.

**REFERENCES**

1. Mallikarjuna G. Hudedmani, Swati I K, Sneha S G, Bassamma B, Vivek M N. Digital Logic Gate Simulation using Arduino microcontroller. Journal of Control System, 2017.
2. MyoSuSuTheint, Zaw Myo Tun. Development of digital logic trainer for student's experimentation. International Journal of Scientific Engineering and Technology Research, 2014.
3. Black, Michael. Export to Arduino: A tool to teach processor design on real hardware. In Computer Science Faculty Publications, 2016.
4. R. Hari Sudhan, M. Ganesh Kumar, A.Udhaya Prakash, et al. Arduino atmega-328 microcontroller. International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, 2015.
5. Janaki Venukumar, Naveen. S. Arduino based door access control. International Journal of Research in Advent Technology, 2016.
6. Black, M., Komala, P. A full system x86 simulator for teaching computer organization. SIGCSE Technical Symposium on Computer Science Education, 2011.
7. Burch, C. A graphical system for logic circuit design and simulation. Journal on Educational Resources in Computing 2:1, 2002.
8. ACM/IEEE Joint Task Force on Computing Curricula. Curriculum Guidelines for Undergraduate Degree Programs in Computer Science, 2013.