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# Smart Dustbin Monitoring

Dr. D.B. Kadam[1], Miss. Aitwade Shreya A[2], Mr Jangam Yogesh K[3], Miss. Patole Surabhi N[4]
[1] *Associate Professor,* [2, 3, 4] *UG Students, Department of Electronics and Telecommunication Engg, P. V. P. Institute of Technology Budhgaon, Sangli*

***Abstract:*** ***In the present day scenario, many times we see that the garbage bins or Dust bin are placed at public places in the cities are overflowing due to increase in the waste every day. It creates unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness; to avoid such a situation we are planning to design "IoT Based Waste Monitoring for Smart Cities". In this proposed System there are multiple dustbins located throughout the city or the Campus, these dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and an unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concern authorities from their place with the help of Internet and an immediate action can be made to clean the dustbins.***
***Keywords: Ultrasonic sensor Arduino LCD display Dustbin***

## I. INTRODUCTION

Due to rapid population growth, disorganization of city governments, a lack of public awareness and limited funding for programs waste management is become a global problem.
The Central Public Health and Environmental Engineering Organization (CPHEEO) has estimated that waste generation in India is as much as 1.3 pounds per person per day. This figure is relatively low, compared to the 4.6 pounds of waste generated per person per day in the United State (U.S.). But the U.S. population was close to 307 million in July 2009, whereas India's population was 1.2 billion.
These statistics mean that India could be generating as much as 27 million more tons of waste than the U.S. per year.
Government of India have struggled for years to find a way to manage the country's ever increasing amount of trash. According to the survey carried out in 1994 the garbage produced in Mumbai is 5800 tons per day. Municipal Corporation of Greater Mumbai (MCGM) operates a huge fleet of 983 Municipal and Private Vehicles for collection of waste making 1396 number of trips each day. Solid Waste Management (SWM) expenditure outlay in the year 2007-08 is Rs.10479.3 Million. But still there is overflow of garbage in many areas in Mumbai. To avoid this smart garbage management system is developed.

### *A. Relevance*

To make the smart dustbin it is necessary to use the electronics technology. Instead if it is done manually it will be difficult and has no use as per requirement. With the help of sensors and microcontrollers we can measure the level of garbage in the dustbin and data can be send to the remote site which is not possible manually. So it is necessary to use the Electronics technology to implement this idea to make the smart city.

### *B. Motivation*

The idea is simple and is driven by the fact that dustbins require very frequent cleaning, which is not always possible. This leads to unhealthy environment and spread of diseases. The aim is to accommodate more and get the dustbin cleaned timely using alert services.

### *C. Problem Definition*

As we seen number of times the dustbins are getting overflown and concern person don't get the information within a time and due to which unsanitary condition formed in the surroundings, at the same time bad smell spread out due to waste, bad look of the city which paves the way for air pollution and to some harmful diseases around the locality which is easily spreadable. Here the issue is the management of garbage. With the help of electronics technology our task is to design the system which will monitor the level of garbage and display it and according to it service will be provided. It will save time to collect the garbage and money required.

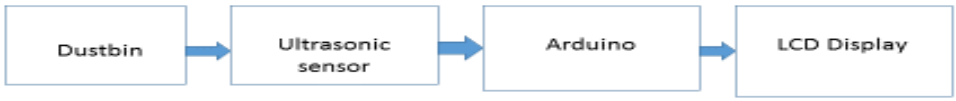
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*D. Technical Approach*

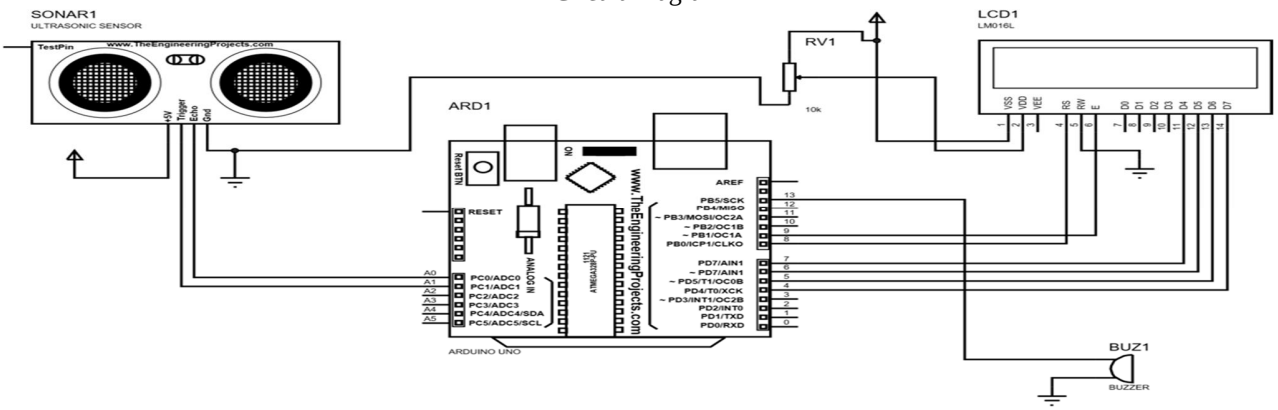
Here level of garbage is measured using sensor and this information of level is given to the microcontroller. Here it is converted to the percentage and this percentage level is wirelessly transmitted. Data will be uploaded in cycles. This can be accessed from anywhere when user logged into the system. For this one web server is used to store the data. This is the real time data transmission and access of data. This will help to avoid the overflow of dustbins.

Block Diagram




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Circuit Diagram




LCD




It is very important to keep a track of the working of almost all the automated and semi-automated devices, be it a washing machine, an autonomous robot or anything else. This is achieved by displaying their status on a small display module. LCD (Liquid Crystal Display) screen is such a display module and a 16x2 LCD module is very commonly used. These modules are replacing seven segments and other multi segment LEDs for these purposes. The reasons being: LCDs are economical, easily programmable, have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. LCD can be easily interfaced with a microcontroller to display a message or status of a device. This topic explains the basics of a 16x2 LCD and how it can be interfaced with AT89C51 to display a character. It is very important to keep a track of the working of almost all the automated and semi-automated devices, be it a washing machine, an autonomous robot or anything else. This is achieved by displaying their status on a small display module. LCD (Liquid Crystal Display) screen is such a display module and a 16x2 LCD module is very commonly used. These modules are replacing seven segments and other multi segment LEDs for these purposes. The reasons being: LCDs are economical, easily programmable, have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. LCD can be easily interfaced with a microcontroller to display a message or status of a device. This topic explains the basics of a 16x2 LCD and how it can be interfaced with AT89C51 to display a character. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers.

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1) *Command Register:* Stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing, clearing the screen, setting the cursor position, controlling display etc.
2) *Data Register:* Stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

| Hex Code | Command to LCD Instruction Register |
|---|---|
| 1 | Clear screen display |
| 2 | Return home |
| 4 | Decrement cursor |
| 6 | Increment cursor |
| E | Display ON, Cursor ON |
| 80 | Force the cursor to the beginning of the 1st line |
| C0 | Force cursor to the beginning of the 2nd line |
| 38 | Use 2 lines and 5x7 matrix |

3) *Ultrasonic Sensor:* Here this sensor is used in order to measure the level of the dustbin filled with garbage. Level will be measured and data is given to the controller for further processing. Ultrasonic sensors overcome many of the weaknesses of IR sensors - they provide distance measurement regardless of color and lighting of obstacles. They also provide lower minimum distances and wider angles of detection to guarantee that obstacles are not missed by a narrow sensor beam. This particular model is an upgrade from the lower precision HC-SRO4. This has 4 pins and can be used in 1-pin trigger/echo or 2-pin.It has range of 2cm to 400 cm. Its operating frequency is 40 kHz. It's a 4 pin device as shown in fig.

## II. HOW DO ULTRASONIC SENSOR WORKS?

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object. While some sensors use a separate sound emitter and receiver, it's also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.While radar and ultrasonic sensors can be used for some of the same purposes, sound-based sensors are readily available—they can be had for just a couple dollars in some cases—and in certain situations, they may detect objects more effectively than radar.For instance, while radar, or even light-based sensors, have a difficult time correctly processing clear plastic, ultrasonic sensors have no problem with this. In fact, they're unaffected by the color of the material they are sensing.On the other hand, if an object is made out of a material that absorbs sound or is shaped in such a way that it reflects the sound waves away from the receiver, readings will be unreliable.

If you need to measure the specific distance from your sensor, this can be calculated based on this formula:

Distance = ½ T x C

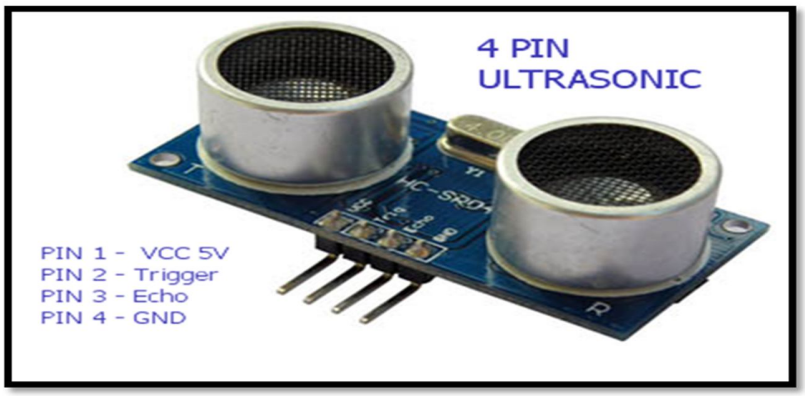
(T = Time and C = the speed of sound)

### A. *Electrical Parameters*

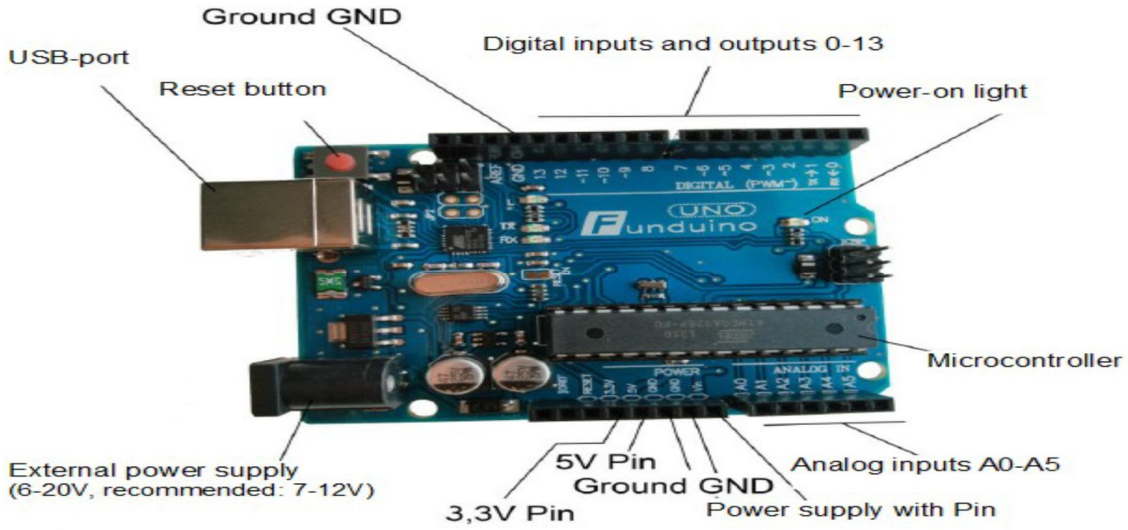
1) Operating Voltage DC 5V
2) Operating Current 15mA
3) Operating Frequency 40KHZ
4) Farthest Range 4m
5) Nearest Range 2cm
6) Measuring Angle 15Degree
7) Input Trigger Signal 10usTTLpulse
8) Output Echo Signal Output TTL level signal, proportional with range
9) Dimensions 45*20*15mm

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Arduino




The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open-source, which means hardware is reasonably priced and development software is free. This guide is for students in ME 2011, or students anywhere who are confronting the Arduino for the first time. For advanced Arduino users, prowl the web; there are lots of resources.

The Arduino project was started in Italy to develop low cost hardware for interaction design. An overview is on the Wikipedia entry for Arduino. The Arduino hardware comes in several flavors. In the United States, Sparkfun is a good source for Arduino hardware.

This guide covers the Arduino Uno board (Sparkfun DEV-09950, $29.95), a good choice for students and educators. With the Arduino board, we can write programs and create interface circuits to read switches and other sensors, and to control motors and lights with very little effort.

Many of the pictures and drawings in this guide were taken from the documentation on the Arduino site, the place to turn if we need more information.

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The Duemilanove board features an Atmel ATmega328 microcontroller operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for talking to the host computer and a DC power jack for connecting an external 6-20 V power source, for example a 9 V battery, when running a program while not connected to the host computer. Headers are provided for interfacing to the I/O pins using 22 g solid wire or header connectors.

The Arduino programming language is a simplified version of C/C++. If we know C, programming the Arduino will be familiar. If we do not know C, no need to worry as only a few commands are needed to perform useful functions.

An important feature of the Arduino is that we can create a control program on the host PC, download it to the Arduino and it will run automatically. Remove the USB cable connection to the PC, and the program will still run from the top each time we push the reset button. Remove the battery and put the Arduino board in a closet for

six months. When we reconnect the battery, the last program we stored will run. This means that we connect the board to the host PC to develop and debug program, but once that is done, we no longer need the PC to run the program.

Buzzer



A buzzer or beeper an audio signalling device which may be mechanical, electromechanical, or piezoelectric .Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination can complete a simple circuit design, to "plug and play."

## III. HARDWARE IMPLEMENTATION

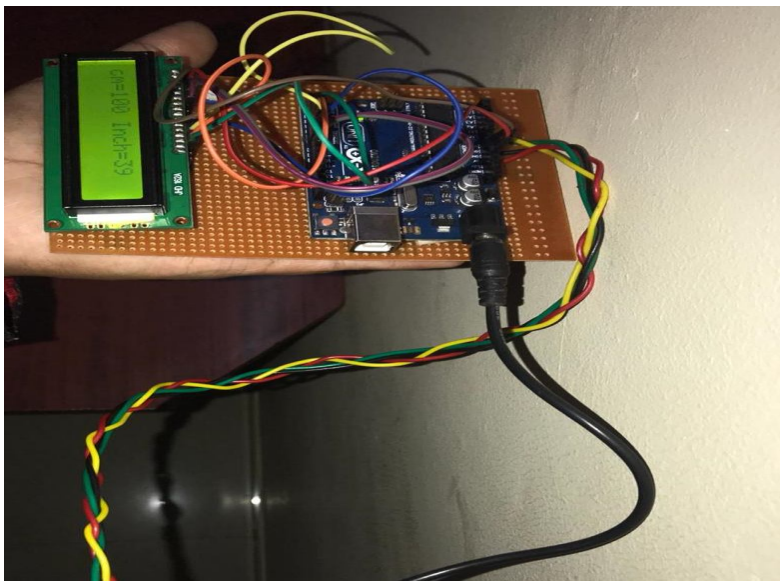
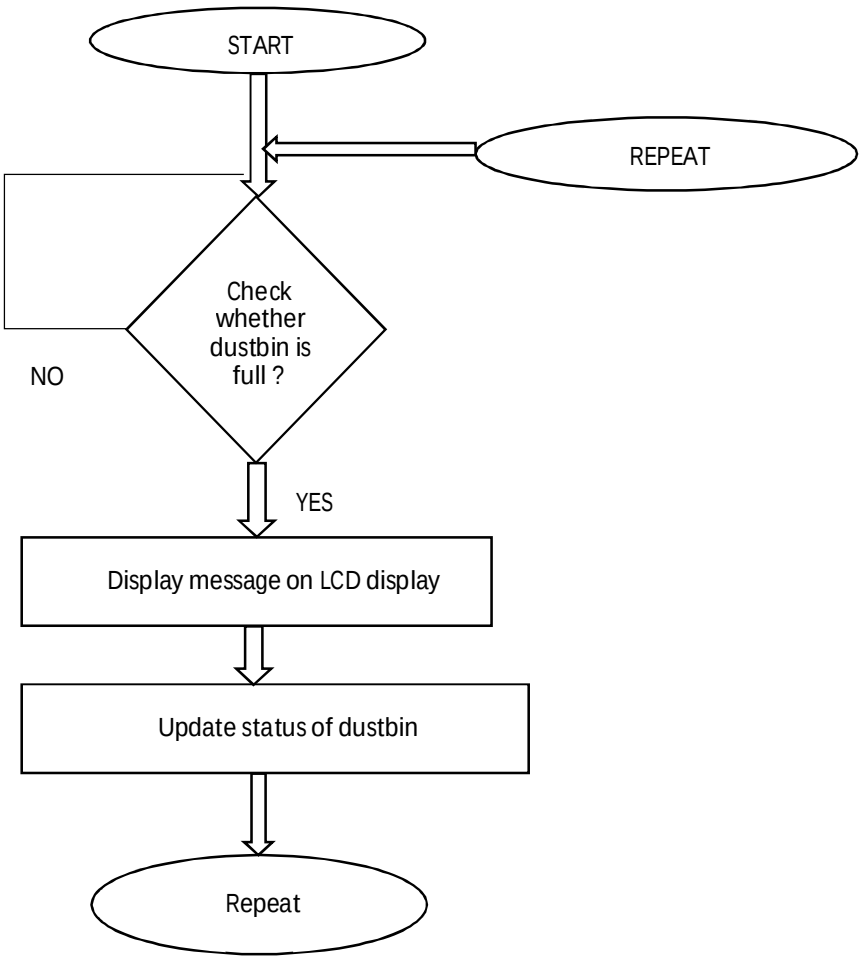


Fig- Hardware Implementation

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## IV. SOFTWARE DESIGN




## V. CONCLUSION

This project solid waste monitoring system has been successfully implemented with the integration of communication technologies such as Arduino, system the proposed system would be able to monitor the solid waste collection process and management the overall collection process.

This technique would provide solid waste collection in time and also overcome all the disadvantages which are as use of minimum route, low fuel use, clean and green environment and available vehicle. The technologies which are used in the proposed system are good enough to ensure the practical and perfect for solid waste collection process monitoring and management for green environment.

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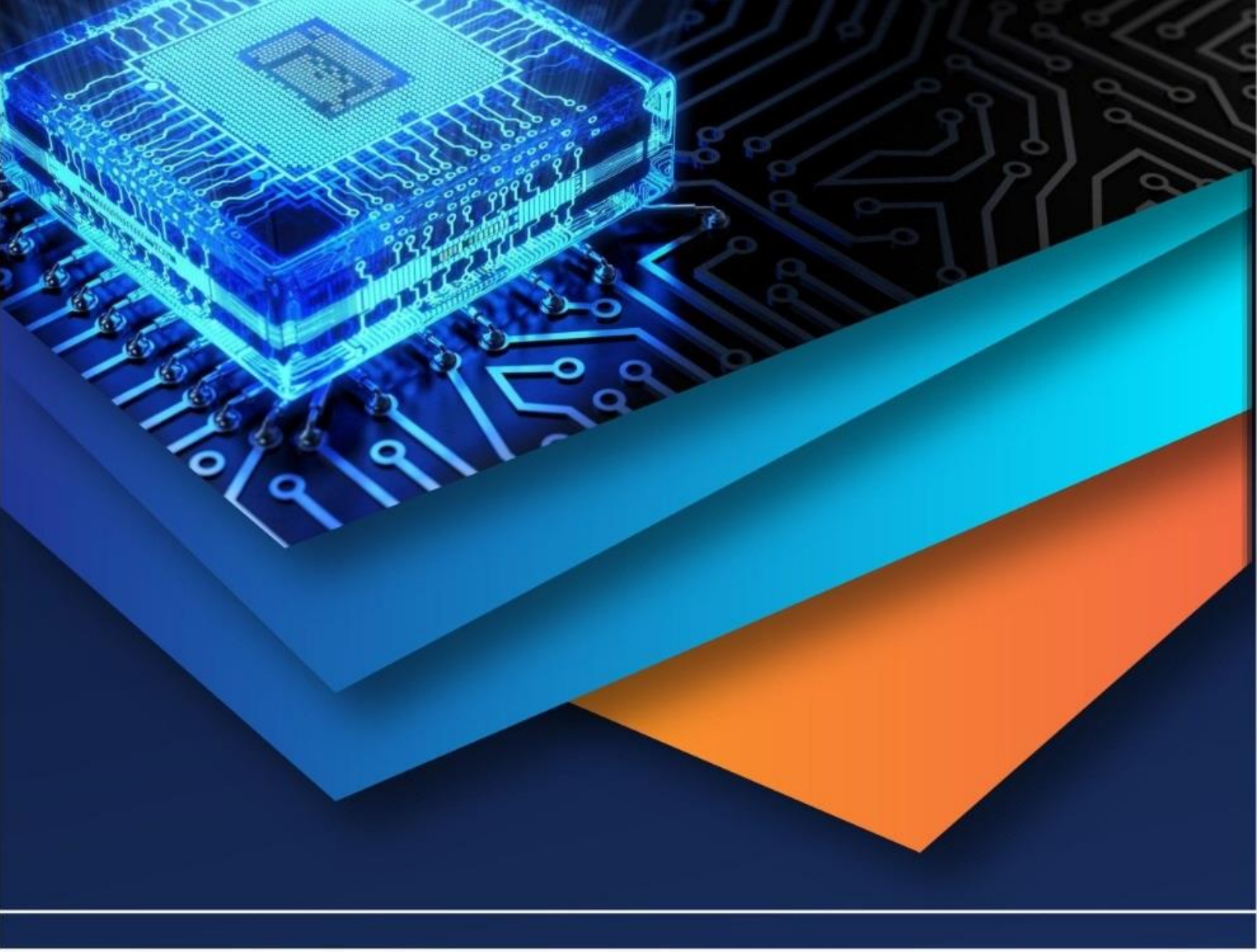
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