# ELECTRONIC DICE
# SOLAR-POWERED WATER DESALINATOR

**20EC5203 – ELECTRONIC DESIGN PROJECT I**

**A PROJECT REPORT**

***Submitted by***


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***in partial fulfillment for the award of the degree***

***of***

**BACHELOR OF ENGINEERING**

***in***

## ELECTRONICS AND COMMUNICATION ENGINEERING


## K.RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

**SAMAYAPURAM-621 112**


## DECEMBER,2024

# K.RAMAKRISHNAN COLLEGE OF TECHNOLOGY

# (AUTONOMOUS)

**SAMAYAPURAM - 621 112**

## BONAFIDE CERTIFICATE

Certified that this project report titled **"ELECTRONIC DICE", "SOLAR-POWERED WATER DESALINATOR"** is the bonafide work of **HARIENI B (811722106027), HARINI M (811722106028), ROSHNI P R (811721106088)** who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported here in does not from part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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**INTERNAL EXAMINER** **EXTERNAL EXAMINER**

# DECLARATION

We jointly declare that the project report on "**ELECTRONIC DICE, SOLAR-POWERED WATER DESALINATOR**" is the result of original work done by us and best of our knowledge, similar work has not been submitted to "**ANNA UNIVERSITY CHENNAI**" for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfillment of the requirement of the award of Degree of **BACHELOR OF ENGINEERING**.

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Place: Samayapuram

Date:

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# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF ABBREVIATIONS

- **CMOS** - Complementary Metal Oxide Semiconductor
- **DECS** - Digital Electronic Cube System
- **DICE** - Digital Interactive Cube Emulator
- **DSS** - Desalination Solar System
- **ECR** - Electronic Cube Roller
- **ED** - Electronic Dice
- **E-DICE** - Electronic Dice Interactive Computational Emulator
- **EDR** - Electronic Dice Roller
- **LED** - Light Emitting Diode
- **LEDICE** - Light-Emitting Digital Interactive Computational Emulator
- **RED** - Randomized Electronic Dice
- **RNDICE** - Random Number Digital Interactive Cube Emulator
- **SDU** - Solar Desalination Unit
- **SOWAD** - Solar Operated Water and Desalination System
- **SPD** - Solar-Powered Desalinator
- **SPDS** - Solar-Powered Desalination System
- **SPWD** - Solar-Powered Water Desalinator
- **SWD** - Solar Water Desalinator
- **USB** - Universal Serial Bus
- **VRED** - Virtual Random Electronic Dice

# CHAPTER–1

# COMPONENTS

## 1.1 PRINTED CIRCUIT BOARD

A printed circuit board (PCB) is a vital component in modern electronics, serving as a robust and organized platform for the interconnection of electronic components. Typically composed of a substrate material, such as fiber glass-reinforced epoxy, the PCB hosts a complex network of conductive pathways. More intricate electronic devices of ten utilize multilayer PCBs, where multiple layers of conductive pathways are stacked a top each other. This design allows for more compact and sophisticated circuits, essential for advanced electronics.

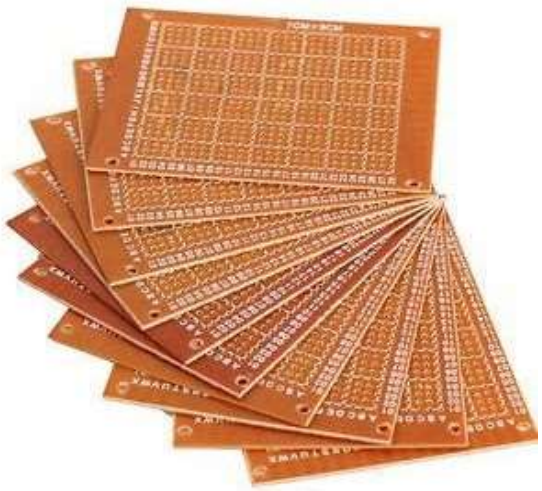

Figure 1.1 PC Board

The fabrication process of a PCB involves several steps. Initially, the circuit design is created using computer-aided design (CAD) software, specifying the arrangement of components and the layout of conductive pathways. They replace traditional point-to-point wiring, reducing the risk of errors and enhancing the overall reliability of the system. Additionally, the compact design of PCBs contributes to the miniaturization of electronic devices, making them more portable and efficient.

## 1.2 555 TIMER IC

The 555 timer IC is a versatile and widely used integrated circuit designed for generating precise timing, pulse, and oscillation applications. Developed in 1972 by Hans R. Camenzind, it operates in three modes: monostable, astable, and bistable. The 555 timer consists of two comparators, a flip-flop, a voltage divider, and a discharge transistor. It has 8 pins, including VCC (power), GND, TRIG (trigger), THRES (threshold), DISCH (discharge), CONT (control voltage), RESET, and OUT (output). Its timing operations depend on external resistors and capacitors.

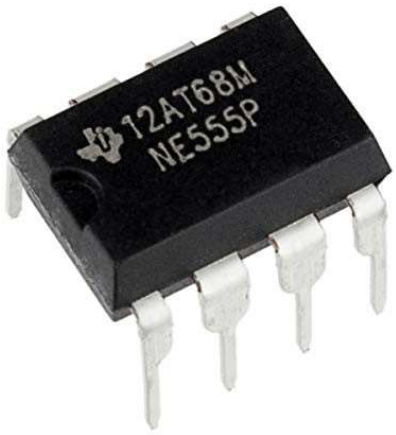


Figure 1.2 555 timer IC

In the monostable mode, the 555 functions as a one-shot timer, producing a single pulse of a defined duration when triggered. In the astable mode, it generates continuous square waveforms, commonly used for clock signals, pulse-width modulation (PWM), and blinking LEDs. In bistable mode, the IC acts as a flip-flop, toggling its output state based on input triggers. Known for its simplicity, reliability, and low cost, the 555 IC is used in a wide range of applications like timers, waveform generators, frequency dividers, and signal modulation circuits. Its versatility makes it a staple in electronics projects and educational experiments.

## 1.3 LED

Light Emitting Diodes (LEDs) represent a ground breaking technology with wide- ranging applications across diverse industries. Functioning on the principle of electroluminescence, LEDs emit light as a result of electrons moving within semiconductor material. The advantages of LEDs are manifold. They excel in energy efficiency by converting a significant portion of electrical energy into visible light, surpassing traditional incandescent bulbs that dissipate a substantial amount as heat. This not only contributes to lower electricity bills but also aligns with global efforts towards energy conservation. The durability of LEDs is a key asset, attributed to their solid-state construction, lacking delicate components like filaments or glass bulbs.

Figure 1.3 LED

Beyond their use in indicators and displays, LEDs play a pivotal role in driving technological advancements. Their low power consumption makes them ideal for battery-operated devices, while their contribution to energy efficiency aligns with sustainability goals. In the automotive industry, LEDs are extensively used in head lights and tail lights, improving visibility and safety. As research and development in this field progress, LEDs are likely to play an even more central role in addressing global energy challenges and fostering innovation across a myriad of applications.

## 1.4 INTEGRATED CIRCUIT

An Integrated Circuit (IC) is a compact arrangement of interconnected electronic components, such as transistors, resistors, capacitors, and diodes, fabricated on a semiconductor material. The miniaturized design of an IC allows for the integration of multiple functions and electronic circuits into a single chip, providing a significant advancement in electronic technology. Digital ICs, such as microprocessors and memory chips, process binary information, enabling the operation of computers and digital devices. Analog ICs, like operational amplifiers (op-amps) and voltage regulators are designed for continuous signal processing, common in audio amplifiers and power supplies. The 555 timer IC and the 741 op-amp are notable examples.

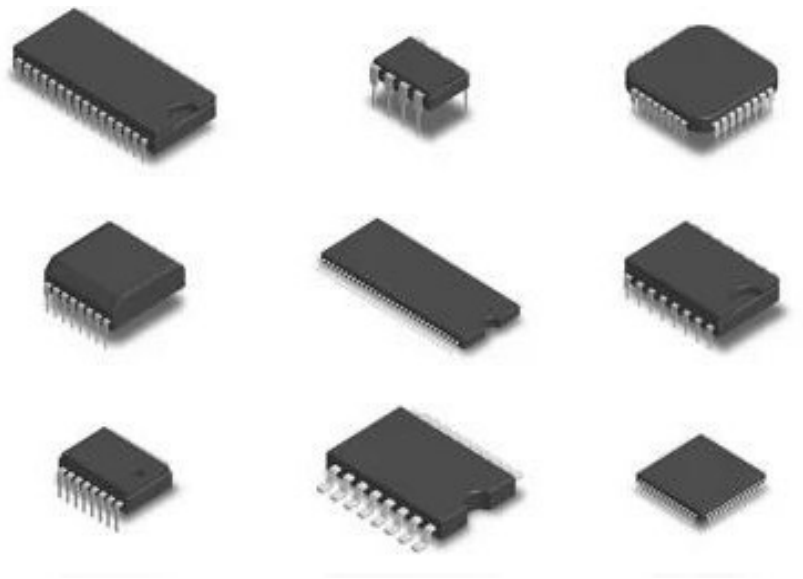

Figure 1.4 Integrated Circuits (ICs)

The 555 timer is widely used for generating time delays, pulse-width modulation, and oscillations. The 741 op-amp, on the other hand, is versatile and commonly used in amplifiers and signal processing applications. The compact nature of ICs enables the creation of complex electronic systems while minimizing space requirements, power consumption, and manufacturing costs. Integrated Circuits have revolutionized the field of electronics, contributing to the development of countless electronic devices, from computers and smartphones to medical equipment and communication devices.

## 1.5 RESISTOR

A resistor is a fundamental electronic component that opposes the flow of electric current. It is a passive two-terminal device with the primary function of controlling or limiting the amount of current passing through a circuit. Resistors are crucial in electronics for adjusting voltage levels, protecting components from excessive currents, and defining time constants in various applications. Resistors come in various types, including fixed resistors with specific resistance values and variable resistors like potentiometers and rheostats that allow manual adjustment. The resistance of a resistor is measured in ohms (Ω) and is governed by Ohm's Law, which relates the voltage (V), current (I), and resistance (R) in a circuit through the equation $V = I \times R$. In electronic circuits, resistors play essential roles in voltage dividers, signal conditioning, and setting bias points for active devices like transistors.

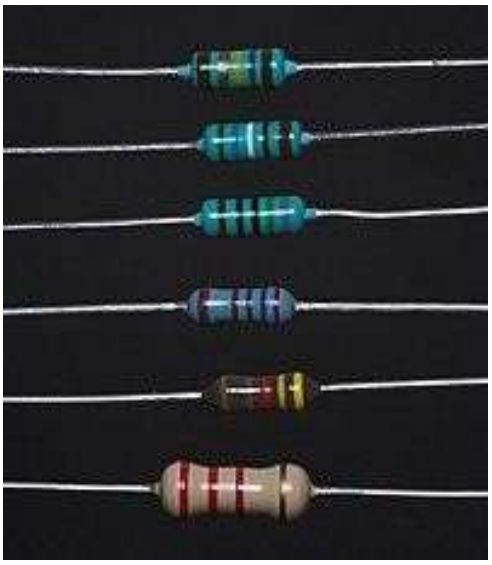

Figure 1.5 Resistor

Moreover, in setting bias points for active devices like transistors, resistors contribute to stabilizing and controlling the operation of these components. They are also employed in filters, oscillators, and numerous other applications where precise control of electrical parameters is necessary. Resistors are foundational components in circuit design, offering control and stability in the flow of electric current, contributing to the overall functionality and performance of electronic systems.

## 1.6 CAPACITOR

A capacitor is a fundamental electronic component that stores and releases electrical energy in a circuit. It consists of two conductive plates separated by an insulating material called a dielectric. When a voltage is applied across the plates, an electric field is established, causing the accumulation of positive and negative charges on the respective plates. Capacitors are versatile components with various applications in electronics. They play a crucial role in smoothing voltage fluctuations, filtering signals, and providing energy storage in circuits. The ability to store electrical energy temporarily makes capacitors valuable in timing circuits, coupling AC and DC signals, and decoupling power supplies. The capacitance of a capacitor, measured in farads (F), indicates its ability to store charge.

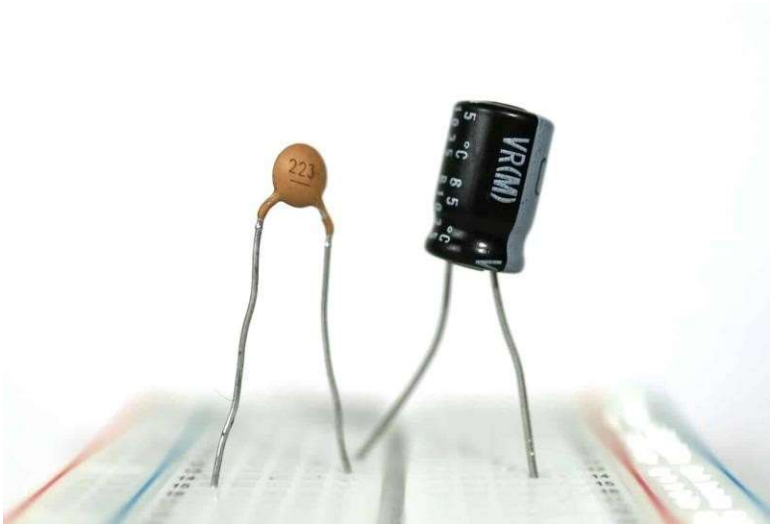


Figure 1.6 Capacitor

In electronic circuits, capacitors are essential for stabilizing power supplies, eliminating noise, and facilitating the proper functioning of various electronic components. They play integral roles in audio systems, power amplifiers, filters, and numerous other electronic devices, contributing significantly to the efficiency and performance of electrical systems. Capacitor is a native runtime for building modern web apps with native mobile functionality. It enables developers to use web technologies like HTML, CSS, and JavaScript to create cross-platform mobile applications for iOS, Android, and the web.

## 1.7 PUSH-BUTTON SWITCH

A push-button switch is a simple mechanical device used to control electrical circuits. It operates by pressing a button that makes or breaks a connection, either momentarily or permanently, depending on the switch type. Push-button switches are widely used in electronic and electrical applications for their ease of operation and reliability. There are two main types: momentary and latching. Momentary switches, like doorbells, return to their original state when released, while latching switches, like power buttons, stay in their new state until pressed again. These switches often have configurations such as normally open (NO) or normally closed (NC), which dictate the default circuit state.

Figure 1.7 Push-button Switch

Push-button switches are constructed from materials like plastic or metal, with spring mechanisms enabling the button's return. They are available in various designs and sizes, tailored to applications ranging from industrial machinery to consumer electronics. Their advantages include durability, simple design, and versatility, making them a staple in circuits where on/off control or user input is needed. Push button switches are commonly used in electronics, appliances, and industrial systems due to their ease of use, durability, and compact design. They can also be used for both low and high voltage applications.

## 1.8 CONNECTING WIRES

Connecting wires form the indispensable infrastructure of electronic circuits, serving as the vital conduits that establish electrical pathways and facilitate the seamless flow of electric current. These wires, typically composed of conductive materials like copper or aluminum, play a fundamental role in ensuring the proper functioning of circuits, both on bread boards and within complex electronic systems. The primary function of connecting wires is to link various components within a circuit, creating the necessary electrical connections for the circuit to operate as intended. Their conductivity allows for the transmission of electrical signals between different elements, forming the essential links that enable communication and cooperation among circuit components. Beyond their basic role in establishing electrical connections, connecting wires contribute significantly to the organization and structure of circuit layouts. Their flexibility allows for the creation of specific signal paths, aiding in the systematic arrangement of components.

Figure 1.8 Connecting wires

Different lengths accommodate diverse circuit layouts, while distinct colors aid in visually distinguishing between various connections. This visual clarity becomes particularly crucial during the prototyping and experimentation stages of electronic system development, where designers and engineers need to troubleshoot and optimize circuit configurations. As technology advances, the importance of well-designed and well-organized connecting wires remains paramount in the pursuit of innovation and progress in the field of electronics.

## 1.9 POWER SUPPLY

A battery stands as a fundamental component in the realm of portable electronics, operating as a versatile electrochemical device designed to store and deliver electrical energy through a controlled chemical reaction. Typically composed of one or more electrochemical cells, a battery consists of positive (cathode) and negative (anode) electrodes immersed in an electrolyte solution. The chemical interaction between these components, when a circuit is closed, triggers a reaction that results in the flow of electrons, generating electrical energy. Alkaline batteries, for instance, are ubiquitous in everyday devices due to their reliability and cost-effectiveness.

**Figure 1.9** Battery

Rechargeable batteries, a notable category, contribute significantly to sustainability efforts by minimizing waste and promoting resource efficiency. Particularly economical for devices with frequent usage patterns, rechargeable batteries not only reduce environmental impact but also prove cost-effective over time. Batteries serve as omnipresent power sources, indispensable for a broad spectrum of electronic devices. Their role extends from powering small everyday gadgets to being the driving force behind electric vehicles. In an era where electronic devices are integral to daily life.

# CHAPTER–2

# ELECTRONIC DICE

## 2.1 ABSTRACT

Traditional dice are widely used in board games, but their physical nature can lead to issues such as wear and tear, misreading of results, and biased outcomes due to imperfections. Furthermore, physical dice are not always practical for digital or remote gaming environments, where accurate, quick, and random number generation is essential. An electronic dice system offers an efficient, reliable, and bias-free solution, enhancing the gaming experience by providing true randomness, ease of use, and integration with digital platforms. It can be a valuable tool in education and gaming applications, providing flexibility and accuracy, while reducing reliance on physical dice, which can be lost or damaged.

While smart phone apps and online random number generators exist, they often lack the tactile, interactive experience of rolling dice. Additionally, current solutions may not be easily integrated into physical gaming environments. Our project addresses these limitations by creating an innovative, modular electronic dice system that offers real-time interaction, true randomness, and seamless integration into both digital and physical gaming platforms.

## 2.2 INTRODUCTION

Playing with dice is an age old game. We all love to play with it too. Playing with dice needs us to pick up a dice and make sure that it is unbiased. Making a block as a dice and cutting it clearly to make sure that it is unbiased is all an old story. The dice becomes biased if the shape is not cut well. Also, the dice can become biased due to deformations. If it is a wooden die, it can deform due to dampness in the atmosphere or due to mechanical stress. To solve all these problems which we have with a conventional dice.

The Electronic Dice project is designed to replace traditional dice with a durable and consistent electronic alternative. Using a 555 timer IC to generate clock pulses and a 4017 counter IC to count them, the circuit produces random numbers from 1 to 6 displayed on a seven-segment LED. The project eliminates issues like wear, bias, and limited use of physical dice while showcasing fundamental electronics concepts such as timing, counting, and display control.

The Electronic Dice project addresses the need for a more reliable and adaptable alternative to traditional dice. Physical dice are prone to wear, bias, and loss, making them less suitable for long-term or integrated applications. This project provides a solution by combining standard electronic components to create a compact and user- friendly system. The dice roll is activated by a push button, and the result is displayed on a seven-segment LED. The main scope of this project is to create a functional prototype of the electronic dice using basic electronic components. It ensures seamless operation between the timer IC, counter IC, and seven-segment display. The system finds applications in board games, educational tools, and digital gaming projects, offering durability, precision, and ease of integration. The project eliminates use of physical dice while showcasing fundamental electronics concepts such as timing, counting, and display control.

## 2.3 COMPONENTS USED

- PCB - 1
- LEDs - 6
- 555 Timer IC - 1
- Decade Counter IC - IC4017 (1)
- Resistors - 1KΩ, 10KΩ, 470Ω (1,1,7)
- Capacitors - 100nF (1) and 0.001μF (1)
- Push Button - 1
- Battery - 9V (1)
- Connecting Wires - As required

## 2.4 CIRCUIT DIAGRAM

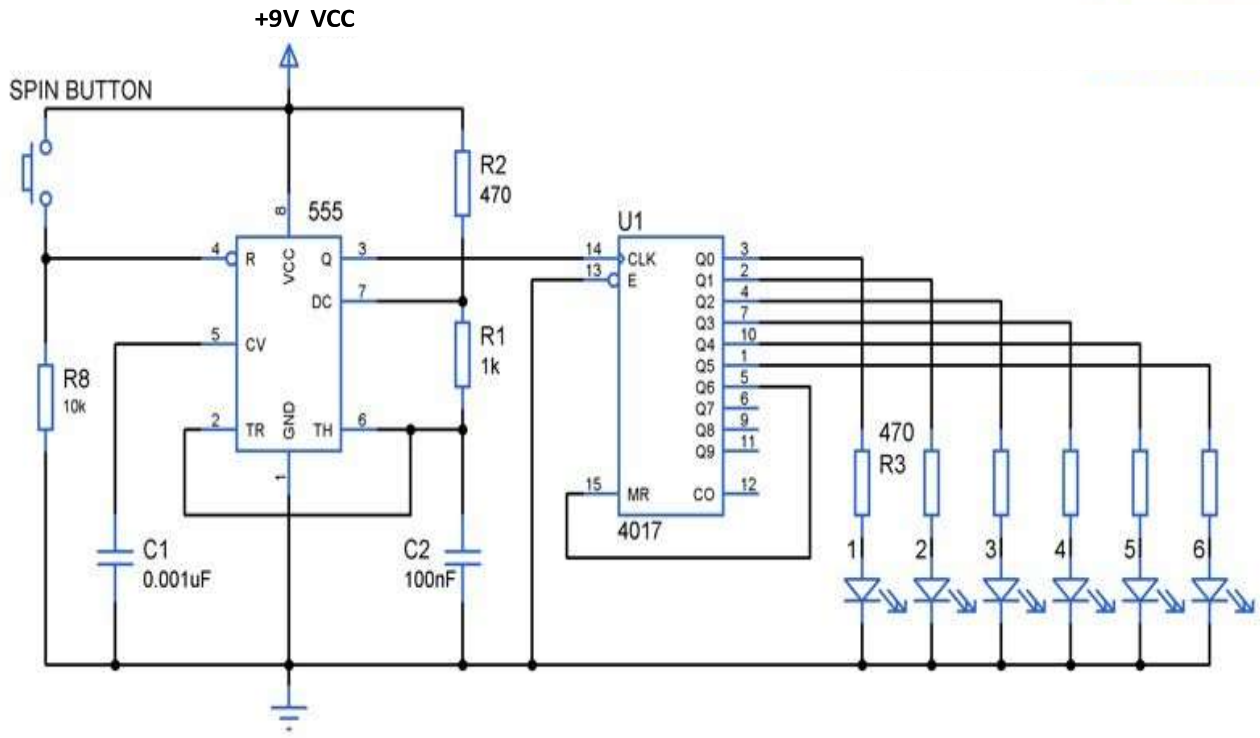


Figure 2.1 Circuit Diagram of Electronic Dice

## 2.5 WORKING MODEL

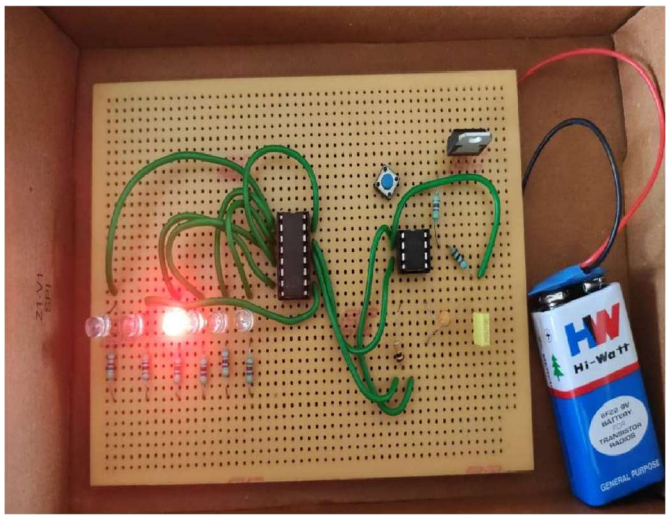


Figure 2.2 Working Model of Electronic Dice

The electronic dice circuit utilizes a 555 Timer IC, configured in astable mode, to generate clock pulses. These pulses simulate the randomness of a dice roll. A push-button switch is used to trigger the circuit. When pressed, the 555 Timer IC starts oscillating, producing rapid pulses at a specific frequency determined by the combination of resistors and capacitors in the circuit. These components define the time constant, ensuring the pulses appear random to the human eye.

The output of the 555 Timer IC is fed into a decade counter IC, such as the CD4017**,** which sequentially activates its output pins with each pulse. Only six output pins of the decade counter are used, corresponding to the six faces of a standard dice. The active output pins control a set of LEDs**,** arranged in the pattern of a physical dice. The LEDs light up in a specific combination based on the counter output, displaying a random dice face.

When the push button is released, the circuit stops generating pulses, and the decade counter holds its last state. This ensures a fixed LED pattern remains visible, representing the dice roll result. A pull-down resistor is used with the push button to avoid false triggering when the switch is not pressed.

Power for the circuit is typically supplied by a 9V battery, ensuring portability. Current-limiting resistors are connected to each LED to protect them from excessive current. In this digital electronic dice circuit we have used 6 LEDs, each LED represent a number (1-6) of Dice. LEDs start flashing as we press the Push button and stops when we release it. After release, illuminated LED tells the numbers, you got on Dice. Like if fifth no, LED remains ON after releasing the button, means you got 5 on Dice. We have connected 6 LEDs to the output Q0 to Q5, and the seventh output Q6 is connected back to the RESET PIN 15. So that after LED 6 it starts from the First LED at Q0. To apply the clock pulse at PIN 14 of 4017 IC, we have used 555 timer IC in astable mode. The oscillated output generated at PIN 3 of 555 has been applied to the PIN 14 of 4017, so that output can be advanced with each clock pulse.

$$\mathbf{F=1.44/((R1+2RV1)\ C1)}$$

In this digital dice circuit, we have kept the oscillation frequency so high that no one can cheat. LED flashing speed is directly proportional to oscillation frequency of 555, has high the frequency, as high the speed of flashing. You can increase frequency according to you, by rotating the potentiometer.

## 2.6 BLOCK DIAGRAM

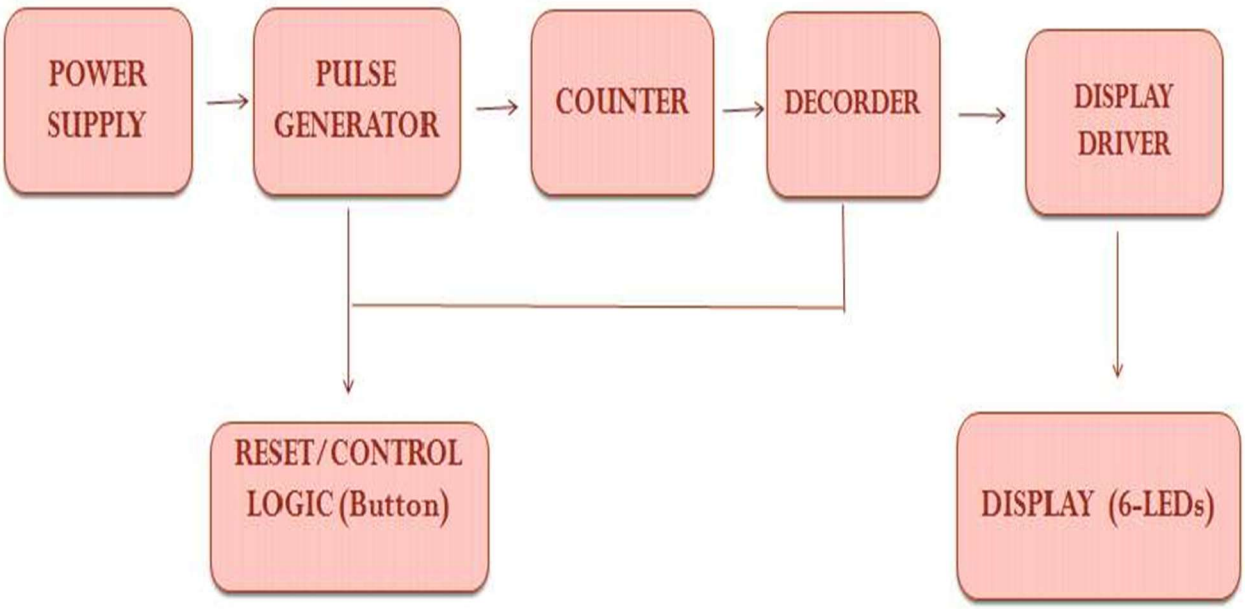


Figure 2.3 Block Diagram of Electronic Dice

### 2.6.1 555 Timer IC

The 555 Timer IC plays a crucial role in the electronic dice circuit by generating clock pulses in astable mode**.** These pulses simulate randomness and drive the decade counter IC (e.g., CD4017), which controls the LED patterns representing dice numbers. The frequency of the pulses is determined by resistors and capacitors connected to the 555 Timer, ensuring a rapid sequence of outputs that appear random when the dice is "rolled." When the push button is released, the timer stops oscillating, allowing the counter to hold its current state. Thus, the 555 Timer enables dynamic and reliable random dice operation.

### 2.6.2 Resistors

In an electronic dice circuit, resistors play a crucial role in controlling the flow of current and setting the timing characteristics of the circuit. Specifically, resistors are used in the 555 Timer IC configuration to set the oscillation frequency in astable mode, determining how fast the dice "rolls" and how the LEDs flash. Common values range from 1kΩ to 10kΩ. The combination of resistors and capacitors defines the pulse width and the timing intervals.

### 2.6.3 Capacitors

In an electronic dice circuit, capacitors play a crucial role in controlling the timing and frequency of the pulses generated by the 555 Timer IC. By determining the time constant, capacitors, along with resistors, set the oscillation period of the 555 Timer in astable mode, thereby controlling the rate at which random numbers are generated. Capacitors smooth out voltage fluctuations, ensuring stable operation of the circuit. Electrolytic and ceramic types are used for stability. The value of the capacitor influences how quickly the counter increments, ultimately determining how fast the LED patterns change, simulating a dice roll.

### 2.6.4 Push Button

The inclusion of a push button introduces a manual reset mechanism to the module. After a short circuit event has occurred and been rectified, users can manually reset the circuit using the push button. This feature ensures flexibility and ease of use in practical applications. The push button, therefore, enhances the user interface of the module, making it more user-friendly. Push button switches are commonly used in electronics, appliances, and industrial systems due to their ease of use, durability, and compact design. They can also be used for both low and high voltage applications.

### 2.6.5 LEDs

In an electronic dice circuit, LEDs play a crucial role in visually displaying the outcome of the dice roll. Each LED represents a segment of a dice face, with a set of six LEDs corresponding to the six sides of a standard dice. The decade counter IC activates specific LEDs based on the counter's output, illuminating them in unique patterns to represent the dice numbers (1 to 6). LEDs provide instant visual feedback, simulating the randomness of a dice roll and allowing users to see the result clearly.

### 2.6.6 IC4017

It is a CMOS decade counter chip**.** It can produce output at the 10 pins (Q0 – Q9) sequentially, means it produce output one by one at the 10 output pins. This output is controlled through the clock pulse at PIN 14. At first, output at Q0 (PIN 3) is HIGH, then with each clock pulse, output advance to the next PIN. Like one clock pulse makes the Q0 LOW and Q1 HIGH, and then the next clock pulse makes the Q1 LOW and Q2 HIGH, and so on. After the Q9, it will start from the Q0 again. So it creates sequential ON and OFF of all the 10 OUTPUT PINs.

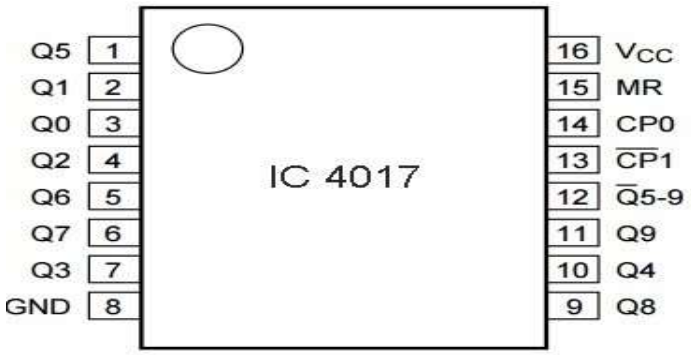


Figure 2.4 Pin Diagram of IC4017

### 2.6.7 Power Supply

A power supply provides electrical energy to a device or system, converting AC to DC or regulating voltage levels. The power supply provides the necessary electrical energy to drive the entire circuit. It is a foundational component that ensures the continuous operation of the system. Without a power supply, the circuit would not function, as the components would have no source of energy to draw from.

## 2.7 ADVANTAGES

- No mechanical parts that can wear out over time.
- Generates random numbers consistently without bias.
- Electronic dice are more reliable than traditional mechanical dice, as they are less prone to wear and tear, ensuring consistent performance over time.
- The use of a 555 Timer IC and a decade counter generates random patterns of LED lights, providing a true random outcome for dice rolls, unlike mechanical dice that may be biased.
- The electronic dice can be easily modified or programmed to change the dice face patterns, add new features, or integrate with other electronic systems, offering more flexibility than physical dice.

## 2.8 APPLICATIONS

- Can replace traditional dice in board games like
    - Snakes and Ladders
    - Ludo
    - Monopoly
    - Business
- Useful in teaching electronics and digital logic.
- Can be integrated into larger electronic projects involving random number generation.
- Electronic dice are sometimes incorporated into lottery and raffle systems randomly select winners or generate random results, ensuring transparency and fairness in the selection process.

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# CHAPTER–3

# SOLAR-POWERED WATER DESALINATOR

## 3.1 ABSTRACT

The increasing scarcity of fresh water due to rising population, climate change, and pollution has made seawater desalination an essential area of research. This project addresses the critical need for sustainable water sources by proposing a solar-powered water desalinator. Traditional desalination methods often rely on fossil fuels, resulting in high energy costs and significant environmental impacts. Our design aims to harness solar energy, making the process more eco-friendly and economically viable. The importance of this project lies in its potential to provide clean drinking water to arid regions, improving public health and agricultural productivity. Additionally, by reducing dependence on non-renewable energy sources, it contributes to climate resilience. Current desalination technologies, such as reverse osmosis and multi-stage flash distillation, face limitations including high energy consumption, infrastructure costs, and brine disposal issues. By leveraging solar energy, our project seeks to overcome these barriers, utilizing advanced materials and efficient designs to enhance water recovery rates while minimizing waste.

## 3.2 INTRODUCTION

The global water crisis has prompted the search for innovative solutions to provide clean drinking water. Desalination, the process of removing salts and impurities from water, is often energy-intensive and expensive. The Solar Powered Water Desalinator is an alternative approach that uses solar power, a renewable energy source, to operate a compact and efficient desalination unit. By converting solar energy into electrical energy, the system powers a steamer and a USB humidifier to distill and condense water.

The Solar Powered Water Desalinator offers an eco-friendly and efficient solution by utilizing solar energy to convert saline water into potable water. This system combines renewable energy with basic electronic components to produce clean water at minimal cost. This project demonstrates how sustainable technologies can address real-world problems. Therefore, the main objective of this project is to utilize solar energy to power the desalination process and develop a low-cost, efficient, and sustainable system.

## 3.3 COMPONENTS USED

- Solar Panel - 1
- Battery - 4V (1)
- Capacitor - 6800µF, 25V (1)
- Diode - IN4007 (1)
- Push Button Switch - 1
- Steamer - 1
- USB Ultrasonic Humidifier - 1

## 3.4 CIRCUIT DIAGRAM

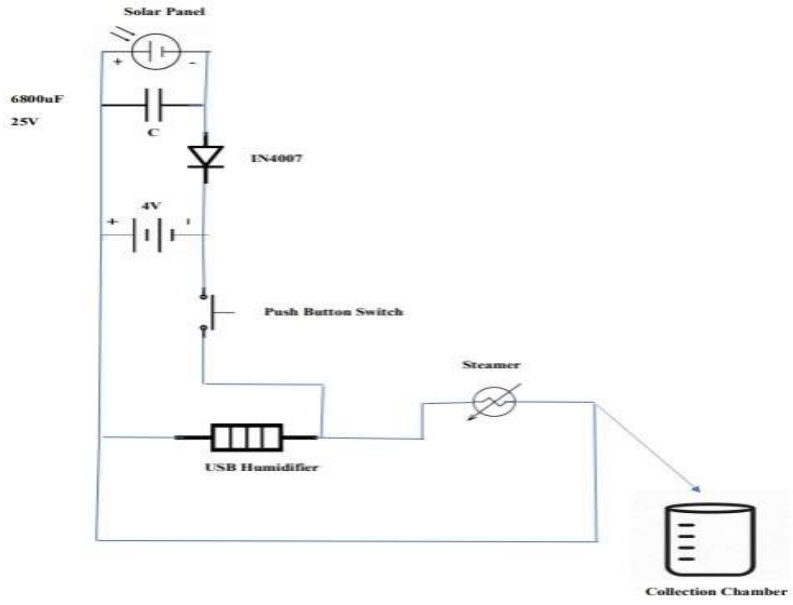


Figure 3.1 Circuit Diagram of Solar-powered Water Desalinator

## 3.5 WORKING MODEL

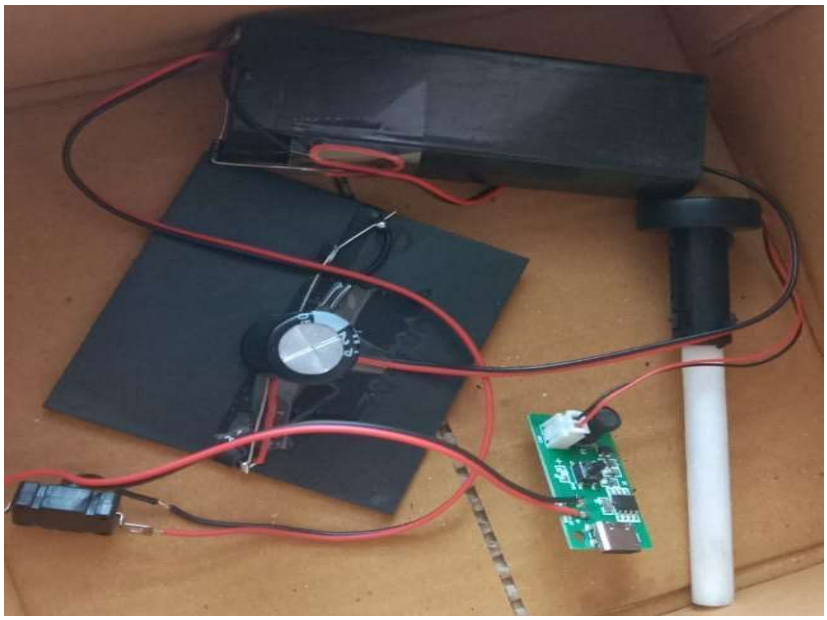

Figure 3.2 Working Model of Solar-powered Water Desalinator

The **Solar-Powered Water Desalinator** is designed to efficiently convert saline water into potable water using renewable energy. Its operation is seamless, combining energy generation, stabilization, and a simple desalination process to ensure effective results with minimal energy consumption. The process begins with **energy generation**, where the solar panel harnesses sunlight and converts it into electrical energy. This energy is stored in a 4V battery, which ensures a continuous power supply even during periods of low sunlight. The stored energy provides the necessary power to operate the system components, making it self- sufficient and sustainable.

To maintain the reliability of the power supply, a capacitor is included in the circuit. This component smooths out voltage fluctuations and ensures that the energy supply remains stable. This step is critical for the consistent operation of the downstream components, especially the steamer and USB humidifier, which rely on a steady input of power for optimal functionality. The system is **activated manually** by pressing a push-button switch, which connects the power supply to the steamer and USB humidifier. This design allows users to control when the desalination process starts, ensuring energy is used only when necessary.

In the **steam generation phase**, the steamer uses the stored electrical energy to heat saline water. As the water heats up, it vaporizes, leaving behind the salts and other impurities. The steam produced is then directed to the USB humidifier, which plays a dual role in the process. During **condensation**, the humidifier cools the steam, converting it back into liquid form as potable water. This clean water is collected for use, while the brine, which contains concentrated salts, is safely discarded.

This systematic approach makes the Solar-Powered Water Desalinator a practical, energy-efficient solution for providing clean water in areas with limited resources.

## 3.6 BLOCK DIAGRAM

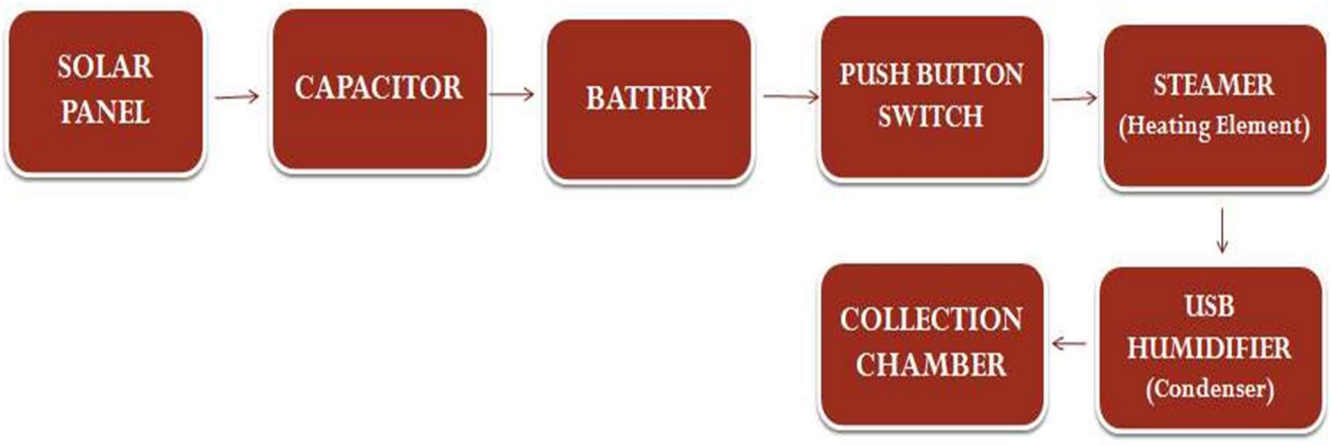


Figure 3.3 Block Diagram of Solar-powered Water Desalinator

### 3.6.1 Solar Panel

A solar panel is the backbone of the system, converting sunlight into electrical energy. The panel used in this project is designed to deliver sufficient voltage and current to charge a 4V battery and power the steamer. It ensures energy independence, making the system sustainable and suitable for remote areas. The efficiency of the solar panel directly impacts the desalination process, as it dictates the energy availability for the system.

### 3.6.2 4V Battery

The 4V rechargeable battery stores the energy generated by the solar panel, providing a stable power supply for the system to operate continuously. It ensures that the system can function during low sunlight conditions, such as during cloudy weather or at night. The battery's capacity is chosen to support the energy requirements of the steamer and humidifier for extended periods.

### 3.6.3 Capacitor

Capacitors play a critical role in electrical systems by stabilizing the voltage. The 6800µF, 25V capacitor used in this project soothes out fluctuations in the energy provided by the solar panel. It ensures that the sensitive electronic components, such as the USB humidifier, operate without damage due to voltage spikes. This component enhances the overall reliability of the system.

### 3.6.4 Push Button Switch

The push button switch provides a simple on/off control mechanism for the system. This user-friendly interface allows the operator to start or stop the desalination process with ease. Its inclusion ensures that the system is intuitive and straightforward, even for users with minimal technical knowledge.

### 3.6.5 Steamer

The steamer is responsible for heating saline water to produce steam. The heat separates pure water vapor from salt and other impurities. The effectiveness of the steamer determines the efficiency of the desalination process. By converting water into steam, the steamer initiates the core function of this system: water purification.

### 3.6.6 USB Humidifier

The USB humidifier acts as the condenser in the system. It condenses the steam produced by the steamer back into liquid water. The humidifier is compact and energy-efficient, making it ideal for this portable system.

## 3.7 ADVANTAGES

- Solar-powered, reducing carbon emissions.
- Lowers operational costs long-term.
- Solves water scarcity sustainably.
- Compact, ideal for emergencies.
- Fewer moving parts; simpler upkeep.
- Reliable water without electricity grid.
- Flexible for small or large applications.
- Clean, zero-emission water production process.
- Handles seawater or brackish water.
- Operates during grid power failures.
- Compatible with other renewable sources.

## 3.8 APPLICATIONS

- Freshwater access for isolated areas.
- Emergency water for disaster zones.
- Freshwater for sailors and fishermen.
- Deserts supplied with clean water.
- Irrigation in freshwater-scarce regions.
- Portable water for remote soldiers.
- Water solutions for small islands.
- Eco-friendly water for resorts.
- Clean water for remote hospitals.
- Sustainable water for coastal industries.
- Teaching sustainability with practical examples.
- Clean water for protected reserves.

# CHAPTER – 4

# CONCLUSION

The “Electronic Dice” module, utilizing a 555 timer IC and six LEDs, successfully demonstrates the fundamental concepts of digital electronics and timing circuits. By employing the 555 timer in astable mode, the circuit generates a time-dependent pulse that controls the operation of the LEDs, simulating the behavior of a traditional dice roll. The use of a 555 timer IC in combination with the LEDs offers an efficient, cost- effective solution for random number generation, which is a key feature of this project. The circuit design is simple yet effective, ensuring that the LEDs light up in a random sequence to represent dice faces from 1 to 6. This project highlights how ICs, resistors, capacitors, and LEDs can be integrated into a functional system to achieve a practical application. The implementation of the timer IC ensures precise control of timing intervals, which is essential for the randomness of the LED pattern, thus mimicking a real dice roll. Overall, this project demonstrates the versatility of the 555 timer IC in various applications beyond its traditional use, showcasing its ability to create engaging electronic systems. The electronic dice is a fun and interactive tool that can be applied in games and educational contexts, providing a hands-on experience in digital circuit design.

The "Solar-Powered Water Desalinator" module combines a solar panel, steamer, and USB humidifier to provide an eco-friendly and sustainable solution for clean drinking water, especially in off-grid or remote areas. Solar power heats seawater, generating distilled water through the steamer and condensation unit. The USB humidifier enhances condensation efficiency, optimizing the desalination process. A battery stores excess solar energy, ensuring continuous operation during cloudy weather or at night, reducing reliance on conventional power sources. This system is ideal for rural, coastal, or disaster-affected regions where access to clean water is scarce. The user-friendly push-button switch allows for easy operation, while its compact design ensures portability for various applications. Future improvements could increase efficiency and scalability, allowing broader use in diverse settings.

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