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Personal Monitoring Of Blood Pressure Using Android Smart Phones

K.Sivanantham[1], S.Barath[2], K.V.Nagendra[3]
[1,2]*Pursuing B.Tech Information Technology,* [3]*Assistant Professor, Information Technology,*
Prathyusha Institute of Technology and Management Tiruvallur, TamilNadu, India

Abstract: ***Blood pressure (BP) is the pressure exerted by circulating blood upon the walls of blood vessels and is one of the principal vital signs. High blood pressure is a common risk factor for heart attacks, strokes and aneurysms, so diagnosing and monitoring it are critically important. Blood pressure can change from minute to minute, so continuous monitoring offers a much broader picture of cardiovascular health. Systolic blood pressure (SBP) is one of the important vital signs that need to be monitored for personal healthcare. We get the data from the blood pressure sensor and heart beat sensor and given to the micro controller .The micro controller send the data to the mobile phone through the wireless communication. Here we are using Bluetooth technology for wireless data transfer. We can monitor the sensor value whenever the patient needs. If any abnormality occurs, then it will send an email to a person may be the doctor or any relative. People can easily measure the blood pressure value. Therefore it is more efficient for the patient under low cost.***
Key Words: Android, Blood pressure sensor, Bluetooth, Heart beat sensor, UART.

I. INTRODUCTION

Blood pressure (BP) is the pressure exerted by circulating blood upon the walls of blood vessels and is one of the principal vital signs. When used without further specification, "blood pressure" usually refers to the arterial pressure of the systemic circulation, usually measured at a person's upper arm. A person's blood pressure is usually expressed in terms of the systolic pressure over diastolic pressure and is measured in millimeters of mercury (mm Hg). Normal resting blood pressure for an adult is approximately 120/80 mm Hg. Blood pressure varies depending on situation, activity, and disease states, and is regulated by the nervous and endocrine systems. Blood pressure that is pathologically low is called hypotension, and pressure that is pathologically high is hypertension. Both have many causes and can range from mild to severe, with both acute and chronic forms. Chronic hypertension is a risk factor for many complications, including peripheral vascular disease, heart attack, and stroke. Hypertension is generally more common, also due to the demands of modern lifestyles. Hypertension and hypotension go often undetected because of infrequent monitoring. Getting reliable blood pressure readings is not always easy. Visits to the doctor's office can provoke anxiety that distorts blood pressure readings, and even when accurate, such visits provide only one-time snapshots of the patient's condition. Blood pressure can change from minute to minute, so continuous monitoring offers a much broader picture of cardiovascular health. Systolic blood pressure (SBP) is one of the important vital signs that need to be monitored for personal healthcare. Measuring SBP via pulse wave transit time (PWTT) requires monitoring ECG and pulse wave signals simultaneously, which has no portability. Blood pressure is typically measured using a mercury sphygmomanometer or an electronic sphygmomanometer. However, most people do not carry these devices during their daily life.

II. OBJECTIVE

The main objective is to measure SBP which requires a cuff, wrapped around the upper arm and inflated until blood flow is completely cut off. The examiner then gradually releases the pressure, listening to the flow until the pulse can be detected by the blood pressure sensor. Experimental results indicated that there is no obvious difference between SBP measured by the new system and by an electronic sphygmomanometer with error less than 10mmHg. The blood pressure sensor senses the analog signals from the patient and heart beat sensor senses the heart beat of the patient. Since the blood pressure is non-static and changes from minute to minute the analog signals varies. The varying analog signals are sent to the analog to digital converter (ADC 0808). ADC converter converts the varying analog signal to digital signals with the help of the timer. These are controlled by the microcontroller. The retrieved digital signals are amplified and transmitted to the android app. The android app reads the varying digital signals and the result is shown in the form of graph. The result can be sent by the patient via email to the doctor or the relative.

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III. RETRIEVING THE DATA FROM THE MICROCONTROLLER AND SENDING IT TO THE MOBILE PHONE

We get the data from the blood pressure sensor and heart beat sensor and given to the microcontroller .The microcontroller send the data to the mobile phone through the wireless communication. Here we are using Bluetooth technology for wireless data transfer. We can monitor the sensor value continuously. If any abnormality occurs, then it will send message to two persons may be the doctor and any relative.

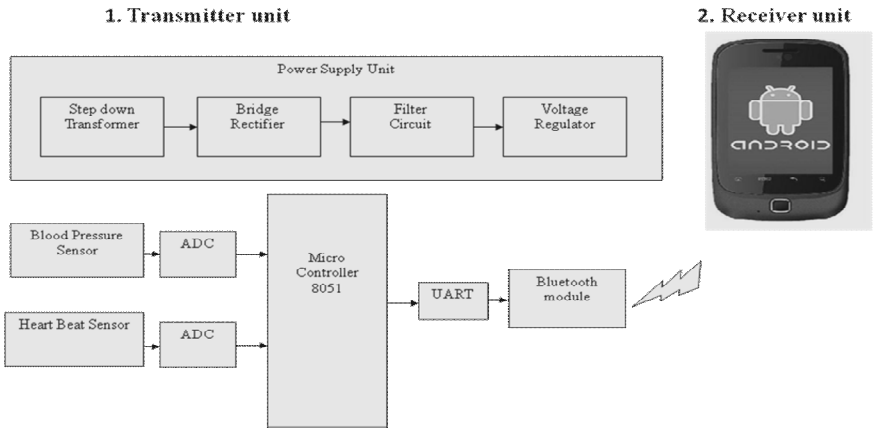

Fig 1. Block diagram

A. Blood Pressure Sensor

It measures Blood pressure using pressure sensor and hand cuffs, and transducer to measure blood pressure and heart rate in three phases: Inflation, Measurement, and Deflation. They include an LCD, selection buttons, memory recall, power management, and USB interface. The digital measurements of pressure and heart rate are performed by the microprocessor. Measurements results are stored in EEPROM or FLASH memory as a data log that can be uploaded to a PC via USB. The analog circuit is used to amplify both the DC and AC components of the output signal of pressure transducer so that we can use the MCU to process the signal and obtain useful information about the patient's health.

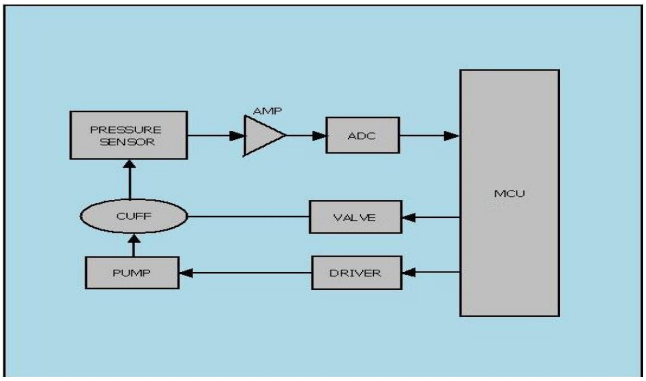

Fig 2. Blood pressure sensor

B. Heart Beat Sensor

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detectors working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

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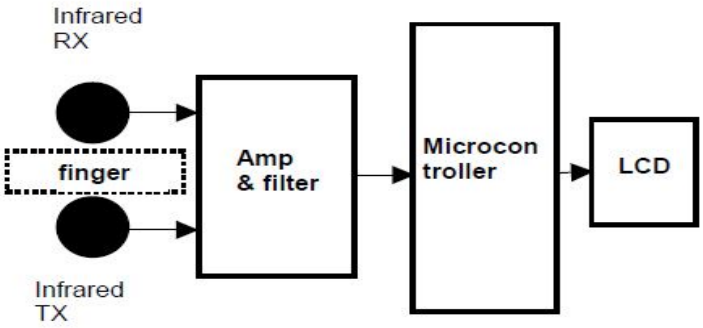

Fig 3. Heart beat sensor

The sensor consists of a super bright red LED and light detector. The LED needs to be superb right as the maximum light must pass spread infringer and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated by a LED which blinks on each heart beat.

C. ADC 0808

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter,8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximations the conversion technique. The converter features high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation registers. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and Latched TTL TRI-STATE outputs. The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/Conversion techniques. The ADC0808, ADC0809 offers high-speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications. For 16-channel multiplexer with common output see ADC0816data sheet.

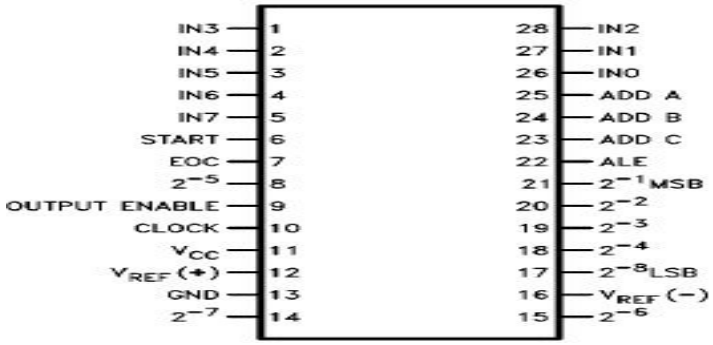

Fig 4. ADC 0808

D. UART

The UART, or Universal Asynchronous Receiver / Transmitter, is a feature of your microcontroller useful for communicating serial data (text, numbers, etc.) to your PC. The device changes incoming parallel information (within the microcontroller/PC) to serial data which can be sent on a communication line. Serial transmission is commonly used with modems and for non-networked communication between computers, terminals and other devices. There are two primary forms of serial transmission: Synchronous and Asynchronous. Depending on the modes that are supported by the hardware, the name of the communication sub-system will usually include a A if it supports Asynchronous communications, and a S if it supports Synchronous communications.

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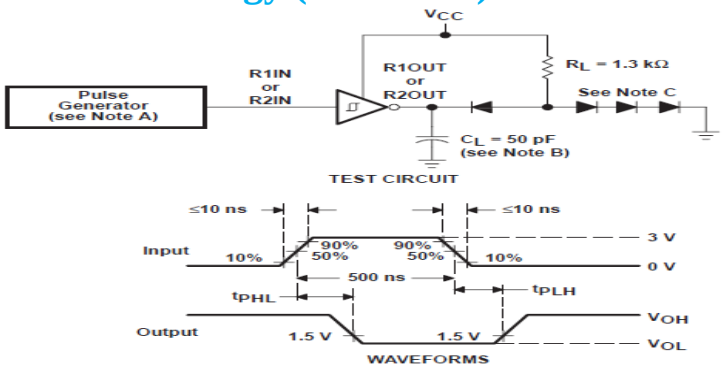

Fig 5. Parameter measurements of UART

E. Micro controller 8051

The **Intel MCS-51** (commonly referred to as 8051) is a Harvard architecture, CISC instruction set, single chip microcontroller (µC) series which was developed by Intel in 1980 for use in embedded systems. The 8051 can only execute code fetched from program memory. The 8051 does not have any instruction to write to program memory. Most 8051 systems respect this distinction, and so are unable to download and directly execute new programs. The strict Harvard architecture has the advantage of making such systems immune to most forms of malware. Some 8051 systems have (or can be modified to have) some "dual-mapped" RAM, making them act somewhat more like Princeton architecture.

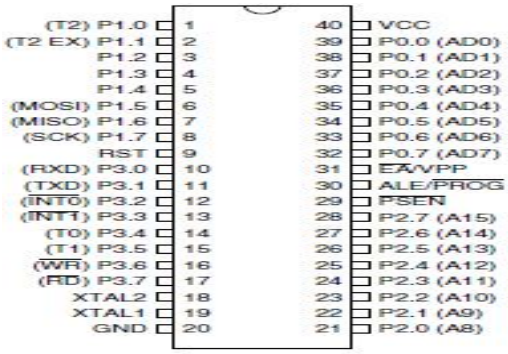

Fig 6. Microcontroller of 8051

F. Bluetooth Module HC 05 Module

Bluetooth is a low cost, low power, radio frequency technology for short-range communications. It can be used to replace the cables connecting portable/fixed electronic devices, build ad-hoc networks or provide data/voice access points. HC-05 is a class-2 Bluetooth module with Serial Port Profile, which can configure as either Master or slave. a Drop-in replacement for wired serial connections, transparent usage. You can use it simply for a serial port replacement to establish connection between MCU, PC to your embedded project.

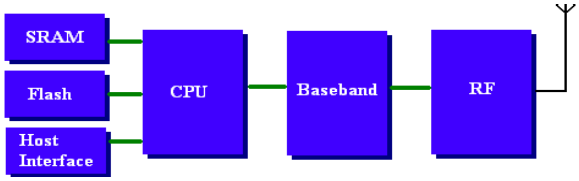

Fig 7. HC 05 Bluetooth module

IV. SOFTWARE REQUIREMENTS

A. Keil Compiler

The Keil C51 C Compiler for the 8051 microcontroller is the most popular 8051 C compiler in the world. It provides more features than any other 8051 C compiler available today. The C51 Compiler allows you to write 8051 microcontroller

applications in C that, once compiled, have the efficiency and speed of assembly language. Language extensions in the C51 Compiler give you full access to all resources of the 8051.The C51 Compiler translates C source files into reloadable object modules which contain full symbolic information for debugging with the µVision Debugger or an in-circuit emulator. In addition to the object file, the compiler generates a listing file which may optionally include symbol table and cross reference information.

B. Embedded C

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. There are a variety of different compilers on the market, manufactured by different companies, that use Embedded C. One of the more popular ones is the Keil compiler. Because of this, Embedded C is also sometimes known as Keil C. Embedded C has several keywords that are not present in C. C offers low-level control and is considered more readable than assembly. Many free C compilers are available for a wide variety of development platforms. The compilers are part of an IDEs with ICD support, breakpoints, single-stepping and an assembly window. The performance of C compilers has improved considerably in recent years, and they are claimed to be more or less as good as assembly, depending on who you ask. Most tools now offer options for customizing the compiler optimization. Additionally, using C increases portability, since C code can be compiled for different types of processors.

C. Android Platforms

Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touch screen mobile devices such as smartphonesand tablet computers, with specialized user interfaces for televisions (Android TV), cars (Android Auto), and wrist watches (Android Wear). The OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Des Android is popular with technology companies which require a ready-made, low-cost and customizable operating system for high devices. Android's open nature has encouraged a large community of developers and enthusiasts to use the open-source code as a foundation for community-driven projects, which add new features for advanced users or bring Android to devices which were officially released running other operating systems. The operating system's success has made it a target for patent litigation as part of the so-called "Smartphone wars" between technology.Android applications are created by several developers around the world to provide good user interface.Thus the android app is created to receive the data from the microcontroller and display it in a graphical format.An E-mail button is placed to send a mail to the doctor or relative.

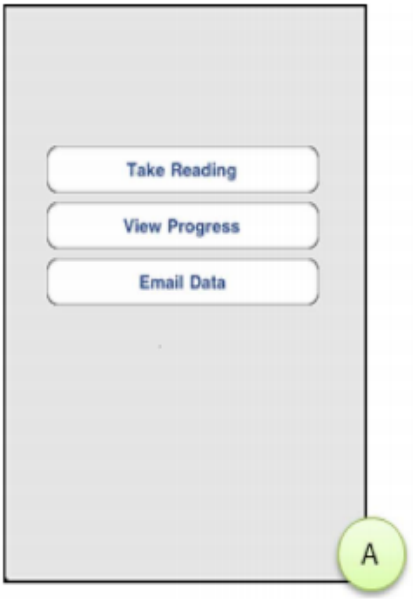

Fig 8, Homepage of the Android app

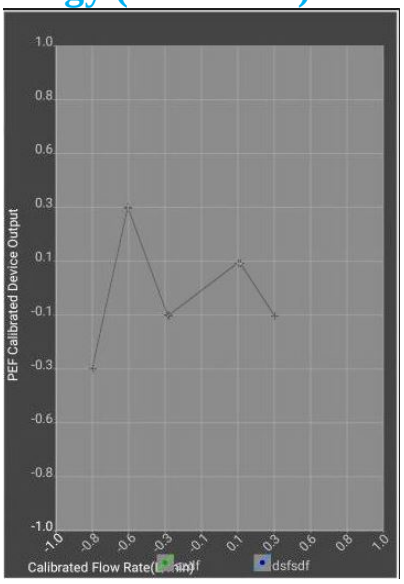

Fig 9, Graphical Representation of Blood pressure

V. CONCLUSIONS

Thus in this system we get the data from the blood pressure sensor and heart beat sensor and given to the microcontroller .The microcontroller send the data to the mobile phone through the wireless communication. By using Bluetooth technology we can monitor the sensor value continuously, for data transfer. If any abnormality occurs, then it will send a mail to a person or a relative. This project presents a sample model of solution technique for monitoring the Blood Pressure. It provides the solution for the patients to easily monitor their blood pressure by themselves. It continuously monitors the patient's Blood pressure due to its non-static state.

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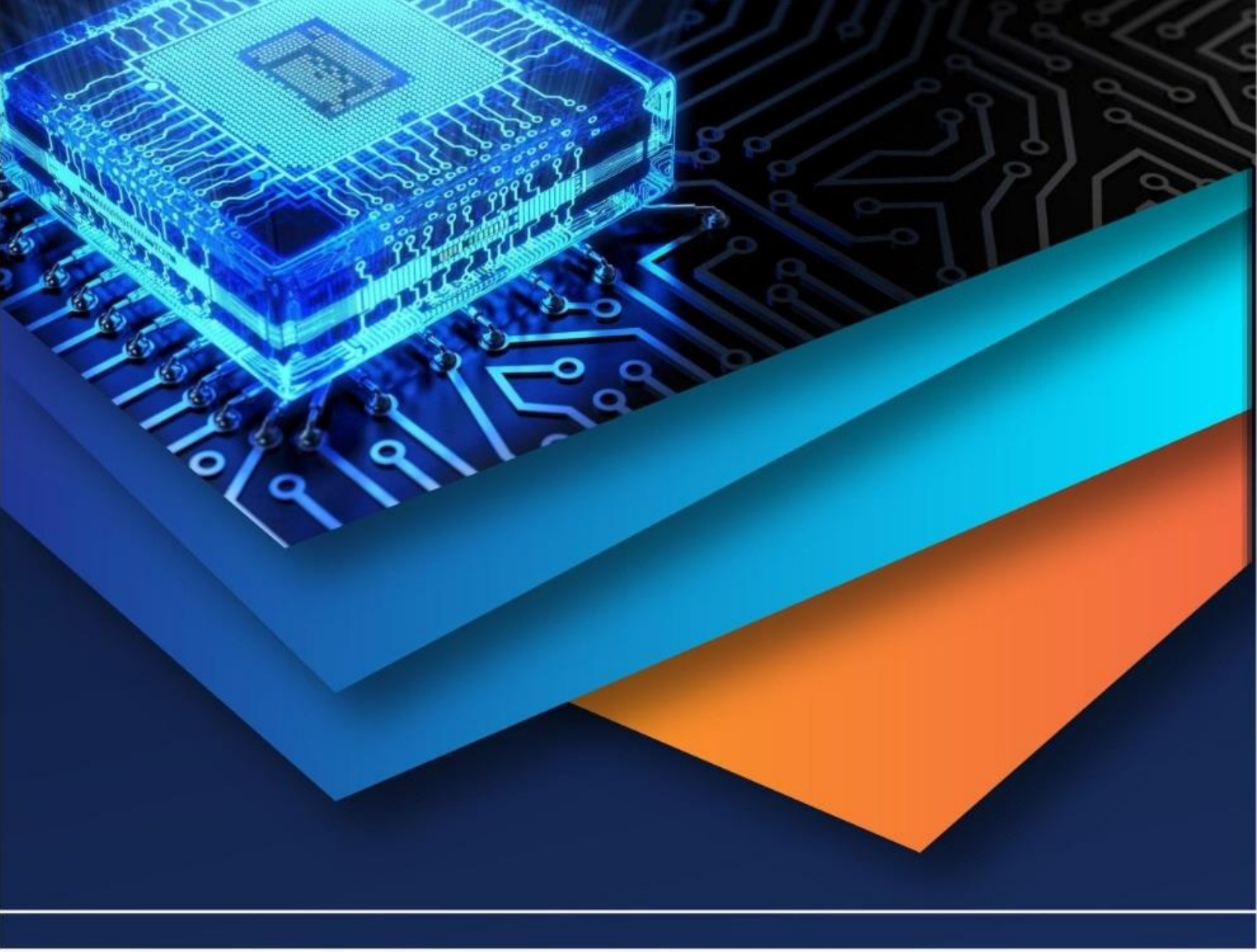

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