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Advanced Autonomous Vehicle Systems and Adaptive Cruise by Using Internet of Things (IOT)

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Abstract: ***There has recently been a significant amount of activity in developing supervisory control algorithms for multiple unmanned aerial vehicle operation by a single operator. While previous work has demonstrated the favorable impacts that arise in the introduction of increasingly sophisticated autonomy algorithms, little work has performed an explicit comparison of different types of multiple unmanned vehicle control architectures on operator performance and workload. This paper compares a vehicle-based paradigm (where a single operator individually assigns tasks to unmanned assets) to a task-based paradigm (where the operator generates a task list, which is then given to the group of vehicles that determine how to best divide the tasks among themselves.) The results demonstrate significant advantages in using a task based paradigm for both overall performance and robustness to increased workload. The proposed framework incorporates sensor constraints, such as processing/travel time. These results have implications for the design of future human-UV systems, as well as more general multiple task supervisory control models***

I. INTRODUCTION

The purpose of the project is to implement a multiple unmanned vehicle control system using a single operator from anywhere in the world. The aim of this paper is to reduce the man power with the help of human automation collaboration. There are two sections in this operation. One is the transmitter part and another section is the receiver section. The receiver section consists of the IoT transceiver and PC and the transmitter section consist of Mini car model, PIC microcontroller and Ultrasonic Sensor, Battery's.
Thus, the implementation of a complete unmanned vehicle system applied to a robotic exploration vehicle is put forward. The proposed system was tested on the robotic platform an unmanned exploration vehicle specialized in recognition

A. Embedded System

A precise definition of embedded systems is not easy. Simply stated, all computing systems other than general purpose computer (with monitor, keyboard, etc.) are embedded systems. System is a way of working, organizing or performing one or many tasks according to a fixed set of rules, program or plan. In other words, an arrangement in which all units assemble and work together according to a program or plan. An embedded system is a system that has software embedded into hardware, which makes a system dedicated for an application (s) or specific part of an application or product or part of a larger system. It processes a fixed set of pre-programmed instructions to control electromechanical equipment which may be part of an even larger system (not a computer with keyboard, display, etc).
A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. In many cases, their "embeddedness" may be such that their presence is far from obvious to the casual observer.
An embedded system is an engineering artifact involving computation that is subject to physical constraints (reaction constraints and execution constraints) arising through interactions of computational processes with the physical world. Reaction constraints originate from the behavioral requirements & specify deadlines, throughput, and jitter whereas execution constraints originate from the implementation requirements & put bounds on available processor speeds, power, memory and hardware failure rates. The key to embedded systems design is to obtain desired functionality under both kinds of constraints.

II. LITERATURE SURVEY

A. Related Work

In recent years, the use of unmanned vehicles (UVs) has become increasingly prominent. Unmanned aerial vehicles (UAVs), ground vehicles (UGVs), surface vehicles (USVs), and undersea vehicles (UUVs) have been used in applications ranging from military operations to border security.

Unmanned ground vehicles (UGVs) have many potential applications, both in military and civilian areas, such as reconnaissance, surveillance, target acquisition, search and rescue, and exploration. Knowledge of UGV behaviors under control commands on different terrain types plays an important role on improving their safety, reliability and autonomy. In this thesis, the complex process involved in a UGV driveline and its interaction with terrain are thoroughly analyzed and a robust low-level control scheme is developed for driving the autonomous vehicle.

Mission and path planning makes use of all known information from prior maps, mission goals , sensory and control structures to generate trajectories, or way points and other actions for the vehicle to execute. However, due to the incomplete knowledge of the world in outdoor missions, the vehicle must use the environment information gathered along the local path to update or rebuild the trajectory.

B. Problem Statement

A significant aspect of the UV control problem is the optimization of a minimum-time trajectory from the UV's starting point to its goal. This trajectory is essentially planar, and is constrained by vehicle dynamics and obstacle avoidance. This optimization problem is difficult because it is non-convex due to the presence of obstacles, and because the spaces of possible control actions over a long trajectory is extremely large. Simplifications that reduce its dimensionality while preserving feasibility and near-optimality are challenging. We can control the Vehicle for particular distance only, because Zigbee having distance limitation respective of particular model.so by using Internet of Things (IoT) we can control the vehicle without any distance limitation.

III. SYSTEM DESIGN

A. Proposed System

This paper focuses on the design and construction of unmanned vehicle with the help of two architecture: A Vehicle-Based Architecture (where a single operator individually assigns tasks to unmanned assets) to a Task-Based Architecture (where the operator generates a task list, which is then given to the group of vehicles that determine how to best divide the tasks among themselves.)

The Unmanned system programming is divided into three main code levels and its hardware was designed with a hierarchical control structure based on modular microcontrollers. The top level program, carried out in C language, is executed in a remote PC and offers to monitor and control the whole robotic vehicle.

The second code level, programmed in C language, runs autonomously on a master PIC16F876A microcontroller. Communication with the remote PC is achieved through the technique IoT for the centralized control of vehicle.

B. System Architecture

1) Block Diagram

a) Receiver Section: Vehicle-2

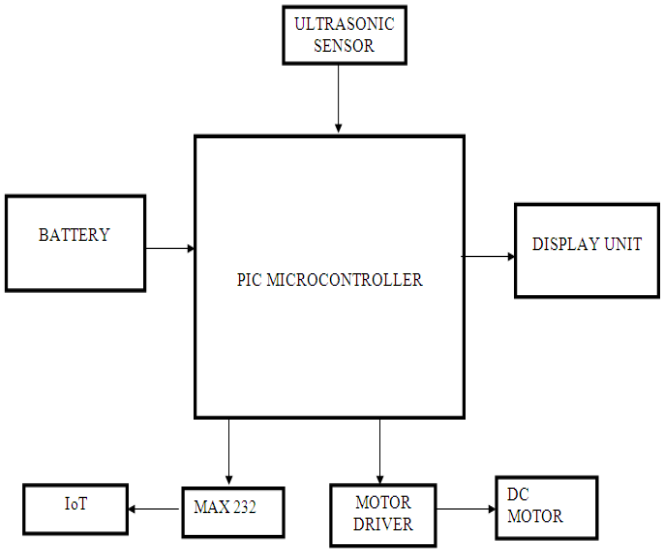


Fig 3.1 Block diagram of this project

b) Transmitter Section

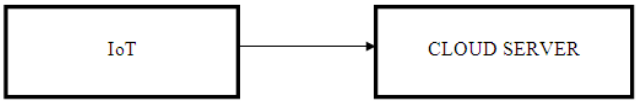


Fig 3.2 Block diagram of this project

2) Circuit Diagram

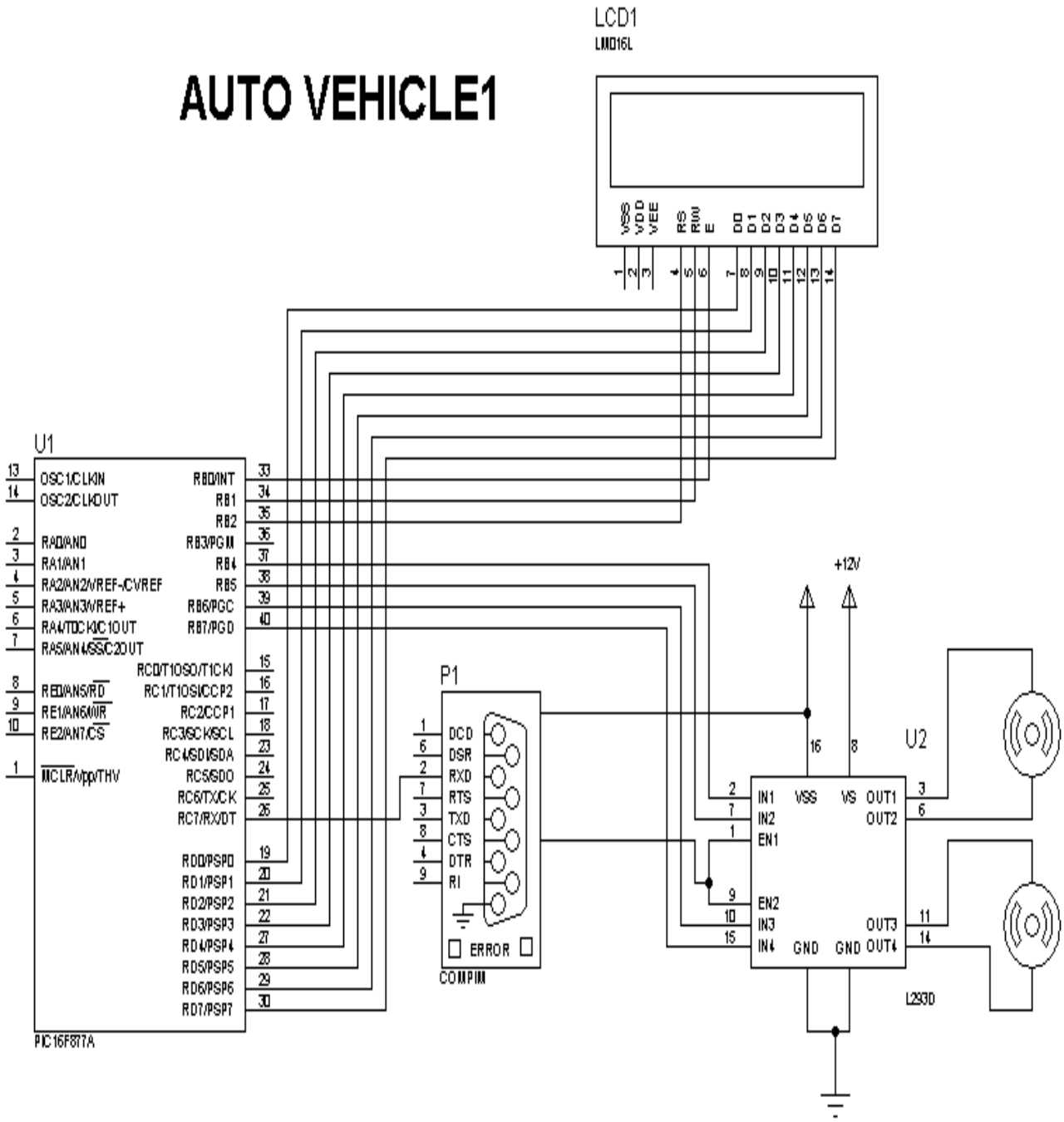


Fig 3.3 Circuit Diagram of this project

3) Flow Diagram

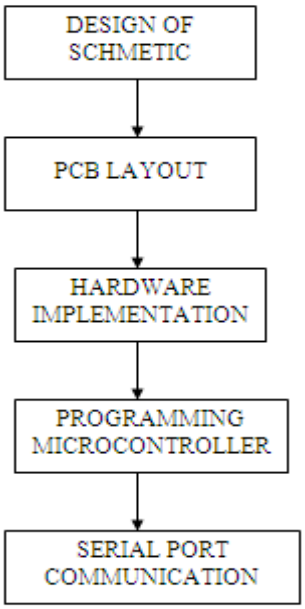


Fig 3.4 Flow Diagram of this project

C. System Specifications

1) Hardware requriment:

a) Microcontroller (PIC16F877A)
b) Motor Driver IC (L293D)
c) DC motor
d) Ultrasonic Sensor
e) IoT
f) Lead Acid Battery

2) Software requriment:

a) Embedded C
b) DOTNET
c) MPLAB IDE (HI-TECH C-COMPILER)
d) Pic Kit 2
e) Proteus 7.8 simulator

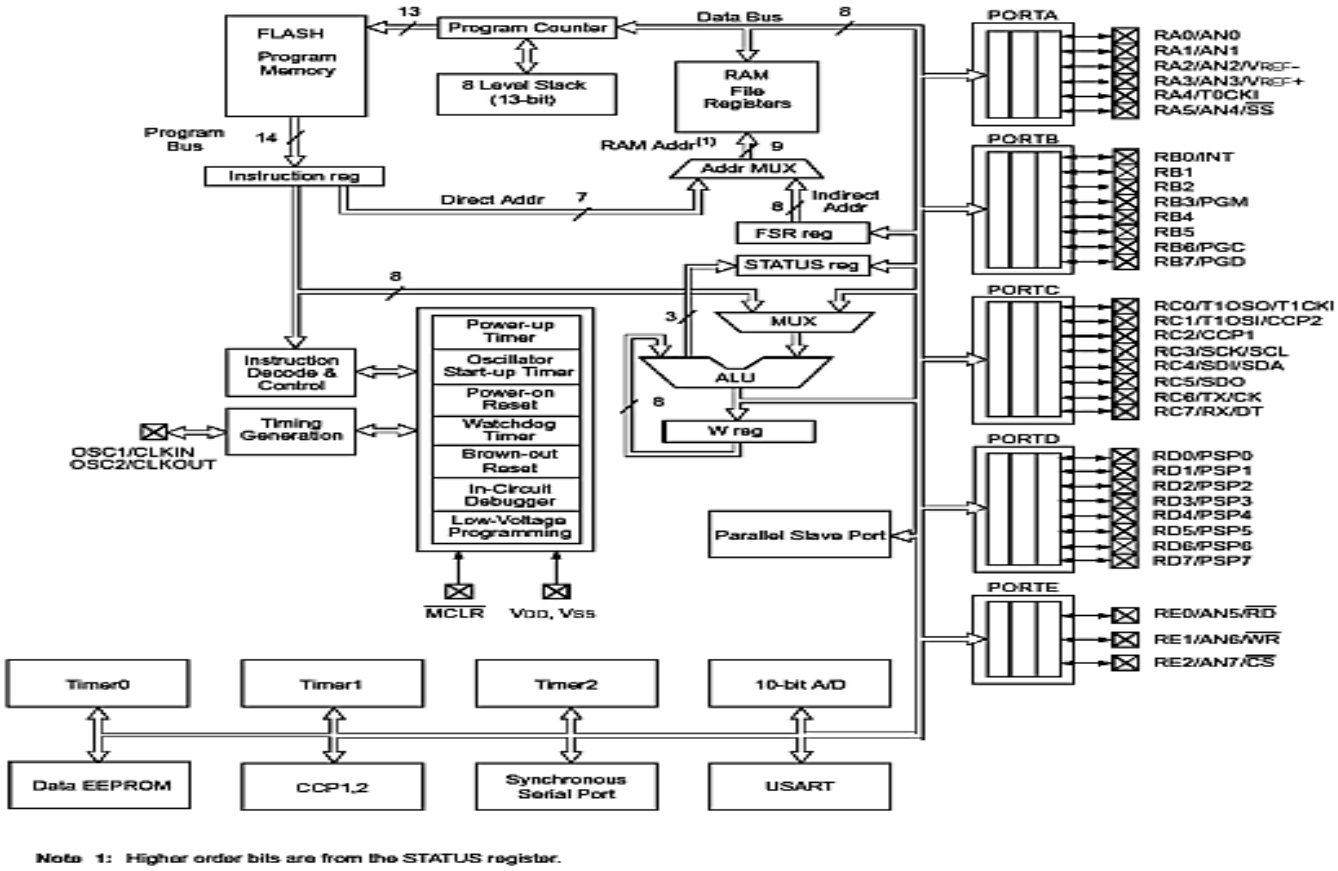
D. Microcontroller-Pic16f877a

1) Features

a) High performance RISC CPU
b) Only 35 single word instructions to learn
c) All single cycle instructions except for program branches which are two-cycle
d) Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle
e) 2K x 14 words of FLASH Program Memory
f) 128 x 8 bytes of Data Memory (RAM)
g) 64 x 8 bytes of EEPROM Data Memory
h) Pin out compatible to the PIC16CXXX 28 and 40-pin devices
i) Interrupt capability (up to 11 sources)
j) Eight level deep hardware stack
k) Direct, Indirect and Relative Addressing modes
l) Power-on Reset (POR)
m) Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)

2) Architecture Diagram Of Pic16f877a

Device	Program FLASH	Data Memory	Data EEPROM
PIC16F874	4K	192 Bytes	128 Bytes
PIC16F877	8K	368 Bytes	256 Bytes



Note 1: Higher order bits are from the STATUS register.

FIG 3.5 Architecture Diagram Of Pic16f877a

3) Pin Diagram Of Pic16f877a

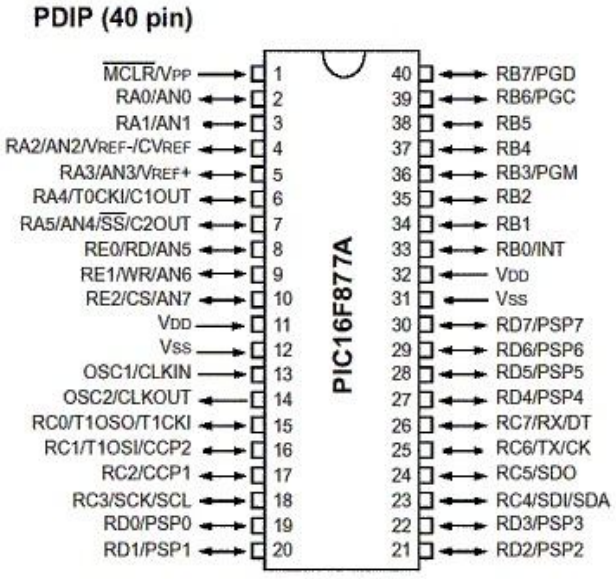


Fig 3.6 Pin Diagram Of Pic16f877a

E. Ultrasonic Sensor

The working of the ultrasonic sensors is quite simple and they are easy to interface with the microcontroller. The sensor module has 4-pins out of which Pin-1 and Pin-4 are +Vcc and Gnd respectively.Pin-2 is Trigger and Pin-3 is Echo pin. The working of sensors can be described from the below figure.

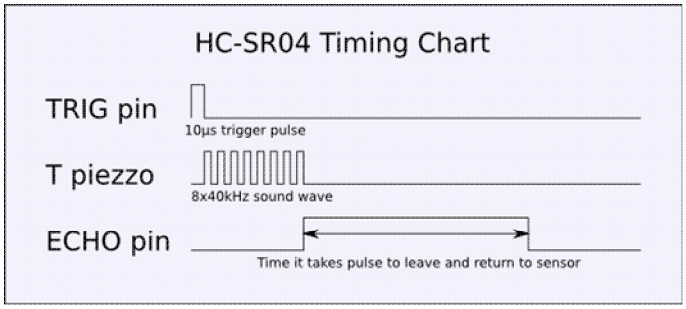


Fig 3.7 Ultrasonic Sensor Timing Diagram

When a High pulse of 10us is applied at TRIG pin, the ultrasonic transmitter sends 8 consecutive pulses of 40 kHz frequency. As the Eighth pulse is sent the ECHO pin of the sensor becomes HIGH. Now when the ultrasonic waves reflect from any surface and are received by the Receiver, the ECHO pin becomes LOW. The time it takes to leave and return to sensor is used to find the distance from the reflecting surface.

Distance in centimeters = (Time/58) cms

In Inches = (Time/148)

Distance can also be calculated by taking into account the speed of Sound (=340m/s)

Fig 3.8 Ultrasonic Sensor

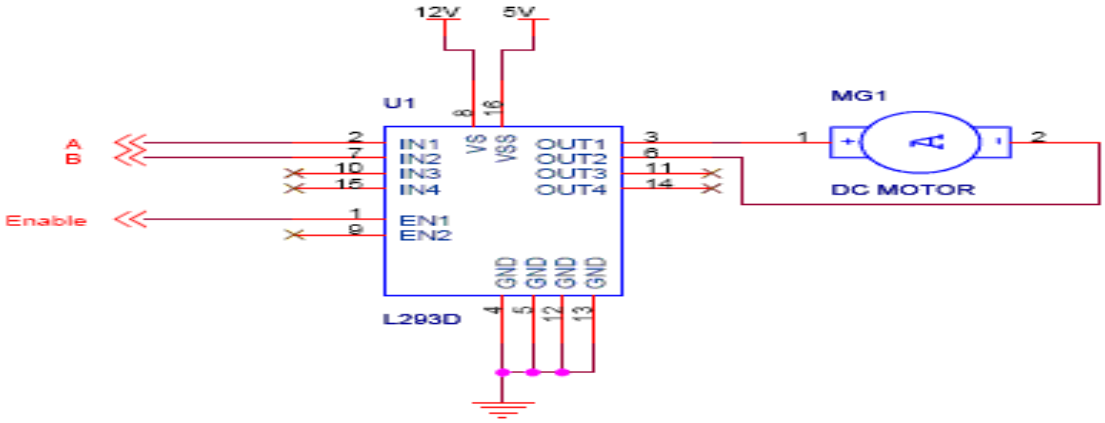
F. Introduction Of Dc Motor

Whenever a robotics hobbyist talk about making a robot, the first thing comes to his mind is making the robot move on the ground. And there are always two options in front of the designer whether to use a DC motor or a stepper motor. When it comes to speed, weight, size, cost... DC motors are always preferred over stepper motors. There are many things which you can do with your DC motor when interfaced with a microcontroller. For example you can control the speed of motor, you can control the direction of rotation, you can also do encoding of the rotation made by DC motor i.e. keeping track of how many turns are made by your motors etc. So you can see DC

Usually H-bridge is proffered way of interfacing a DC motor. These days many IC manufacturers have H-bridge motor drivers available in the market like L293D is most used H-Bridge driver IC. H-bridge can also be made with the help of transistors and MOSFETs etc. rather of being cheap, they only increase the size of the design board, which is sometimes not required so using a small 16 pin IC is preferred for this purpose.

1) L293D: L293D is a dual H-Bridge motor driver, So with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion the you can make use of all the four I/Os to connect up to four DC motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF ouput diodes are included within the IC. The output supply (VCC2) has a wide range from 4.5V to 36V, which has made L293D a best choice for DC motor driver. As you can see in the circuit, three pins are needed for interfacing a DC motor (A, B, Enable). If you want the o/p to be enabled completely then you can

connect Enable to VCC and only 2 pins needed from controller to make the motor work. A simple schematic for interfacing a DC motor using L293D is shown below.



Truth Table

A	B	Description
0	0	Motor stops or Breaks
0	1	Motor Runs Anti-Cloclwise
1	0	Motor Runs Clockwise
1	1	Motor Stops or Breaks

For above truth table, the Enable has to be Set (1). Motor Power is mentioned 12V, but you can connect power according to your motors.

Fig 3.9 L293d with Dc Motor

As per the truth mentioned in the image above its fairly simple to program the microcontroller. It's also clear from the truth table of BJT circuit and L293D the programming will be same for both of them, just keeping in mind the allowed combinations of A and B. We will discuss about programming in C as well as assembly for running motor with the help of a microcontroller.

2) Dc Motor Block Diagram

The name "H-Bridge" is derived from the actual shape of the switching circuit which control the motion of the motor. It is also known as "Full Bridge". Basically there are four switching elements in the H-Bridge as shown in the figure below.

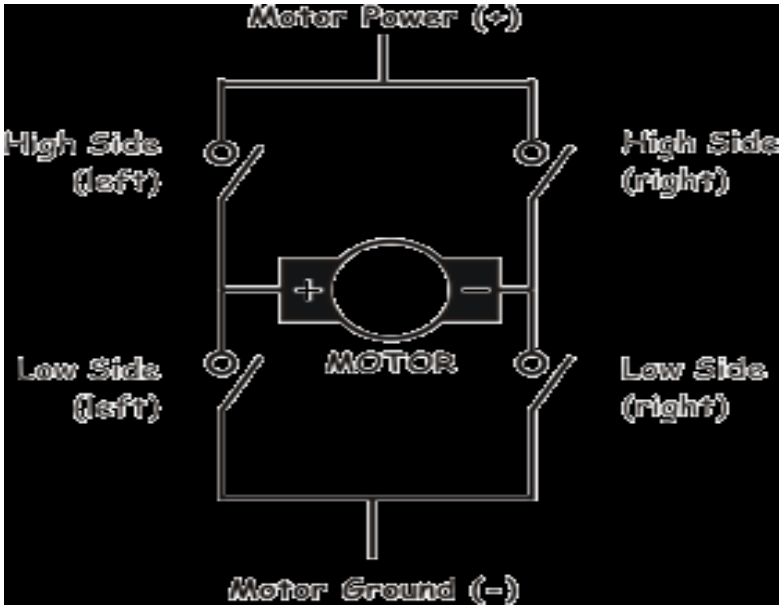
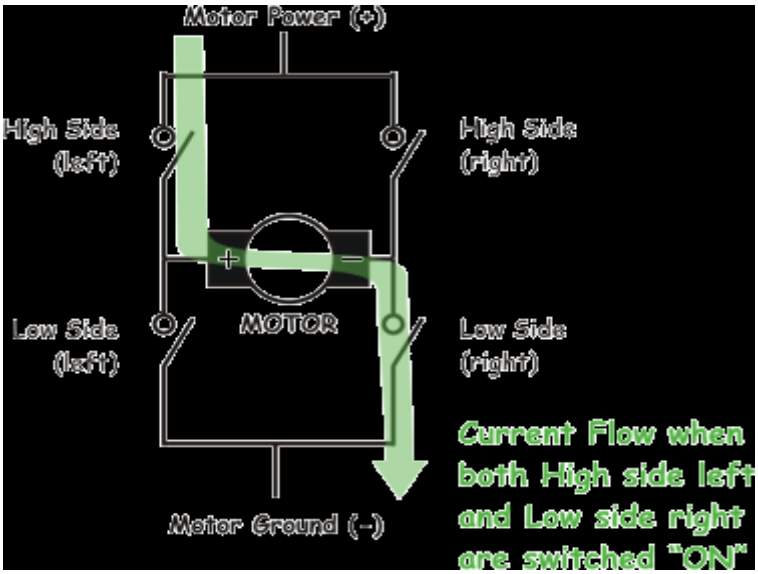


FIG 3.10 H-BRIDGE OF DC MOTOR

As you can see in the figure above there are four switching elements named as "High side left", "High side right", "Low side right", "Low side left". When these switches are turned on in pairs motor changes its direction accordingly. Like, if we switch on High side left and Low side right then motor rotate in forward direction, as current flows from Power supply through the motor coil goes to ground via switch low side right. This is shown in the figure below.

Similarly, when you switch on low side left and high side right, the current flows in opposite direction and motor rotates in backward direction. This is the basic working of H-Bridge. We can also make a small truth table according to the switching of H-Bridge explained above.



Truth Table

High Left	High Right	Low Left	Low Right	Description
On	Off	Off	On	Motor runs clockwise
Off	On	On	Off	Motor runs anti-clockwise
On	On	Off	Off	Motor stops or decelerates
Off	Off	On	On	Motor stops or decelerates

Tab 3.1 Truth Table Of Dc Motor

As already said, H-bridge can be made with the help of transistors as well as MOSFETs; the only thing is the power handling capacity of the circuit. If motors are needed to run with high current then lot of dissipation is there. So head sinks are needed to cool the circuit.

Now you might be thinking why i did not discuss the cases like High side left on and Low side left on or high side right on and low side right on. Clearly seen in the diagram, you don't want to burn your power supply by shorting them. So that is why those combinations are not discussed in the truth table.

So we have seen that using simple switching elements we can make our own H-Bridge, or other option we have is using an IC based H-bridge driver.

G. IOT

IoT (Internet of Things) can be explained as the networking of physical objects with the use of embedded sensors. These sensors collect information about the objects, their surroundings and communicate this information to other stations, linked through wired or wireless networks. The use of IoT started a movement of taking control of devices and making objects speak to one another. Now, the focus seems to have shifted towards making the things intelligent. Kevin Ashton introduced the term Internet of Things, in context of supply chain management. The initial technical realization of IoT was achieved by utilizing RFID (Radiofrequency Identification) technology, which was limited to identification, object tracking and extracting information of specific objects.

However, the current IoT performs sensing, actuating, data gathering, storing, and processing by connecting physical or virtual devices to the Internet. The recent development in the application of IoT has made it useful in the field of waste management. In Indian cities, waste management is mainly handled by Municipal Corporations/Committees. Many of them often suffer from resource crunch in terms of men and machinery. Moreover, the general public is not ready for cost sharing in this process. Seasonal as well as daily variations in waste generation add up to the problem. This renders the waste collection capacity less than the waste generation capacity, which is visible in form of open dumps and overflowing solid waste containers. These issues have thus resulted in increased collection costs and environmental damage. Many researches into waste management have been conducted, ranging from optimization of routes using GIS to RFID tagging have thus been conducted. IoT based systems are one such proposition. This paper proposes an IoT based solution for effective and efficient waste collection. The solution has main focus on the optimal use of waste collection vehicles. The movement of collection vehicles will be linked to the information from the waste collection bins. The system will notify the waste managers upon filling up of the bins and will provide an optimal and effective collection route. The application can use Cloud Analytics and Machine Learning in order to improve the system upon usage. This will help in handling the variations in waste generation.

Internet and its applications have become an integral part of today's human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers went beyond connecting just computers into the web. These researches led to the birth of a sensational gizmo, Internet of Things (IoT). Communication over the internet has grown from user - user interaction to device – device interactions these days. The IoT concepts were proposed years back but still it's in the initial stage of commercial deployment. Home automation industry and transportation industries are seeing rapid growth with IoT. Yet not many articles have been published in this field of study. This paper aims in structuring a state of the art review on IoT. The technology, history and applications have been discussed briefly along with various statistics. Since most of the process is done through the internet we must have an active high speed internet connection. The technology can be simply explained as a connection between humans-computers-things. All the equipment's we use in our day to day life can be controlled and monitored using the IoT. A majority of process is done with the help of sensors in IoT. Sensors are deployed everywhere and these sensors convert raw physical data into digital signals and transmits them to its control center. By this way we can monitor environment changes remotely from any part of the world via internet. This systems architecture would be based on context of operations and processes in real-time scenarios. Smart collection bin works in the similar manner with the combination of sensors namely weight sensor and IR sensor that indicates its weight and different levels respectively. The IR sensors will show us the various levels of garbage in the dustbins and also the weight sensor gets activated to send its output ahead when its threshold level is crossed. These details are further given of the microcontroller and the controller gives the details to the transmitter module (IoT module). At the receiver section a mobile handset is needed to be connected to the IoT router so the details of the garbage bin are displayed onto the HTML page in web browser of our mobile handset.

The Internet of Things (IoT) is a concept in which surrounding objects are connected through wired and wireless networks without user intervention. In the field of IoT, the objects communicate and exchange information to provide advanced intelligent services for users. Owing to the recent advances in mobile devices equipped with various sensors and communication modules, together with communication network technologies such as Wi-Fi and LTE, the IoT has gained considerable academic interests.

The term Internet of Things was introduced by Kevin Ashton, who was the director of the Auto-ID Center of MIT in 1999. The initial technical realization of IoT was achieved by utilizing RFID technology for the identification and tracking of devices and storing device information. However, IoT utilizing RFID technology was limited to object tracking and extracting information of specific objects.

The current IoT performs sensing, actuating, data gathering, storing, and processing by connecting physical or virtual devices to the Internet. For IoT applications performing these functions, a variety of researches on IoT services including environmental monitoring, object tracking, traffic management , health care , and smart home technology are being conducted.

Internet of Things (IoT) is an environment in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. IoT board featured with SIM900 GPRS modem to activate internet connection also equipped with a controller to process all input

UART data to GPRS based online data. Data may be updated to a specific site or a social network by which the user can able to access the data.

Fig.3.11 Block of Iot Sensor

H. Features

1) Power Supply: DC +12v 1Amp.
2) Auto data updating: 30sec
3) Digital Output port Pins: +5V DC
4) Message Format: *message or Data # (Start with * and End with #)
5) Provided with 3 links
a) Data updating to a specific web site
b) Device controlling web site
c) Data updating to a social network

I. Web Server

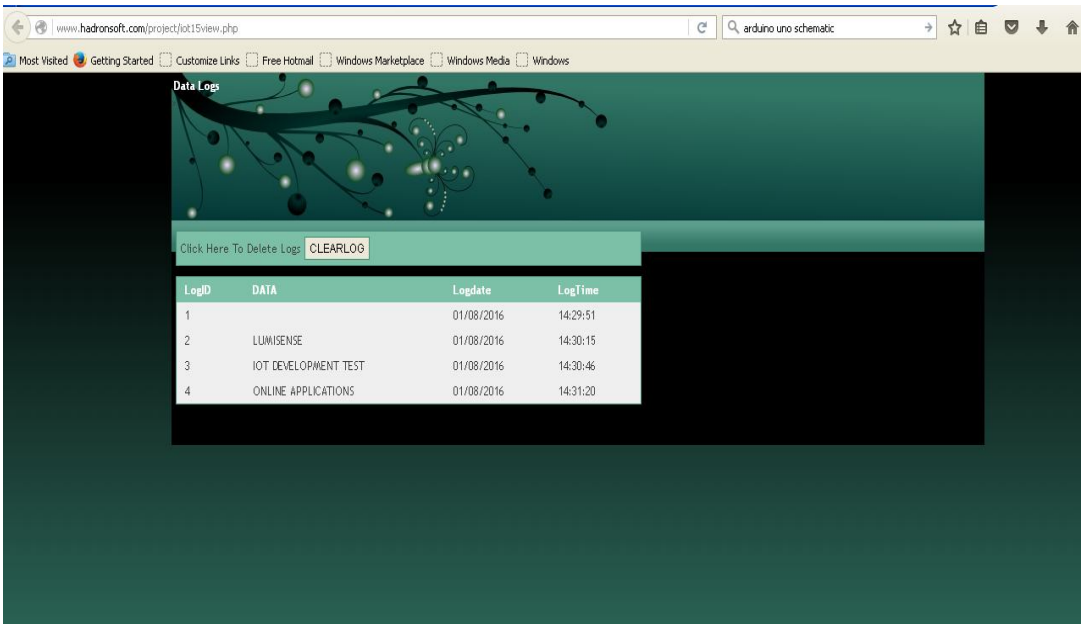


FIG.3.12 WEB SERVER

J. Lcd Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. 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.

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, namely, Command and Data.The 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 it, clearing its screen, setting the cursor position, controlling display etc. The 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. Click to learn more about internal structure of a LCD.

A. Pin Diagram

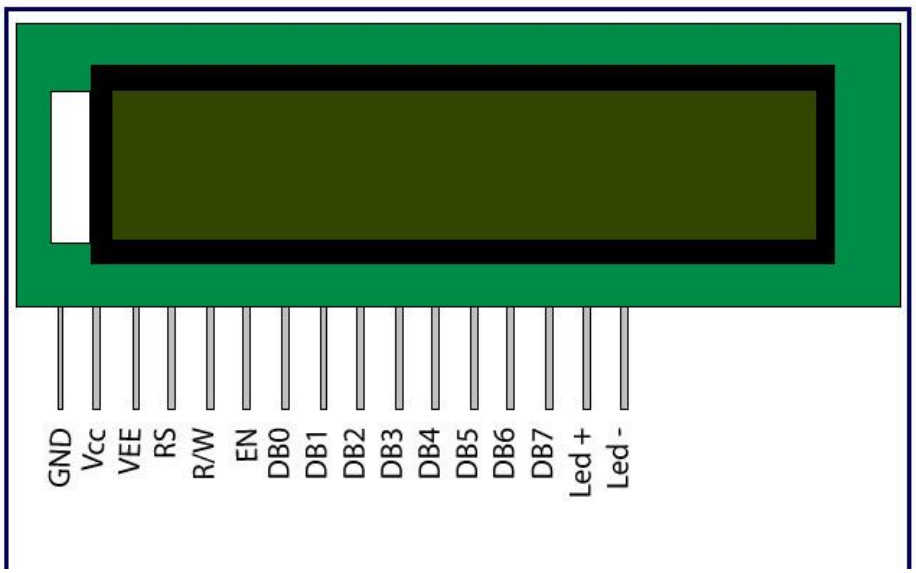


Fig 3.13 Pin Diagram Of Lcd

K. Power Supply

Power Supply is the device that transfers electric power from a source to a load using electronic circuits. Power supplies are used in many industrial and aerospace applications and also in consumer products. Some of the requirements of power supplies are small size, lightweight, low cost, and high power conversion efficiency. In addition to these, some power supplies require the following:

Typical application of power supplies is to convert utility's AC input power to a regulated voltage(s) required for electronic equipment. Depending on the mode of operation of power semiconductors power supply can be linear or switching.

1) *Linear Power Supply:* A linear power supply is the oldest and simplest type of power supply. In these power supplies, electrical isolation can only be provided by bulky line frequency transformers. The ac source can be rectified with a bridge rectifier to get an uncontrolled dc, and then a dc-to-dc converter can be used to get a controlled dc output. Figure 4.9 shows the block diagram of the Linear power supply and figure 4.10 shows the circuit diagram of the power supply The output voltage is regulated by dropping the extra input voltage across a series transistor (therefore, also referred to as a series regulator). They have very small output ripple, theoretically zero noise, large hold-up time (typically 1–2 ms), and fast response. The action of a transformer is such that a time-varying (AC) voltage or current is transformed to a higher or lower value, as set by the transformer turns ratio.

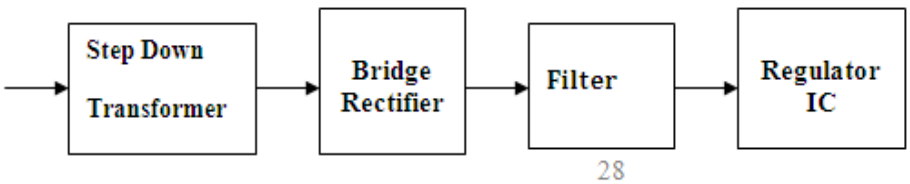


Fig 3.14 Block Diagram of Linear Power Supply

The transformer does not add power, so it follows that the power (V × I) on either side must be constant. That is the reason that the winding with more turns has higher voltage but lower current, while the winding with less turns has lower voltage but higher current. The step down transformer converts the AC input with the higher level to some lower level.

A bridge rectifier converts the AC voltage into DC voltage. A four-transistor converter (Bridge Rectifier) can generate the highest output power than other types of rectifiers. The filter circuit resists the unwanted AC signals. The regulator down-convert a DC voltage to a lower DC voltage of the same polarity.

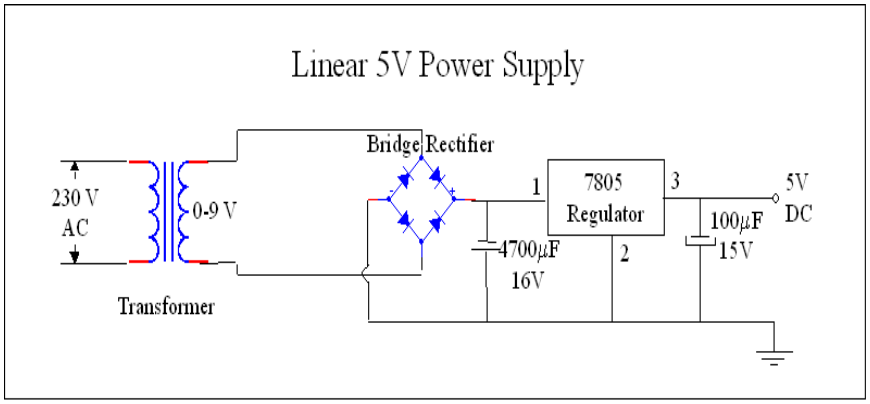


Fig 3.15 Circuit Diagram for 5V power Supply

IV. IMPLEMENTATION AND RESULTS

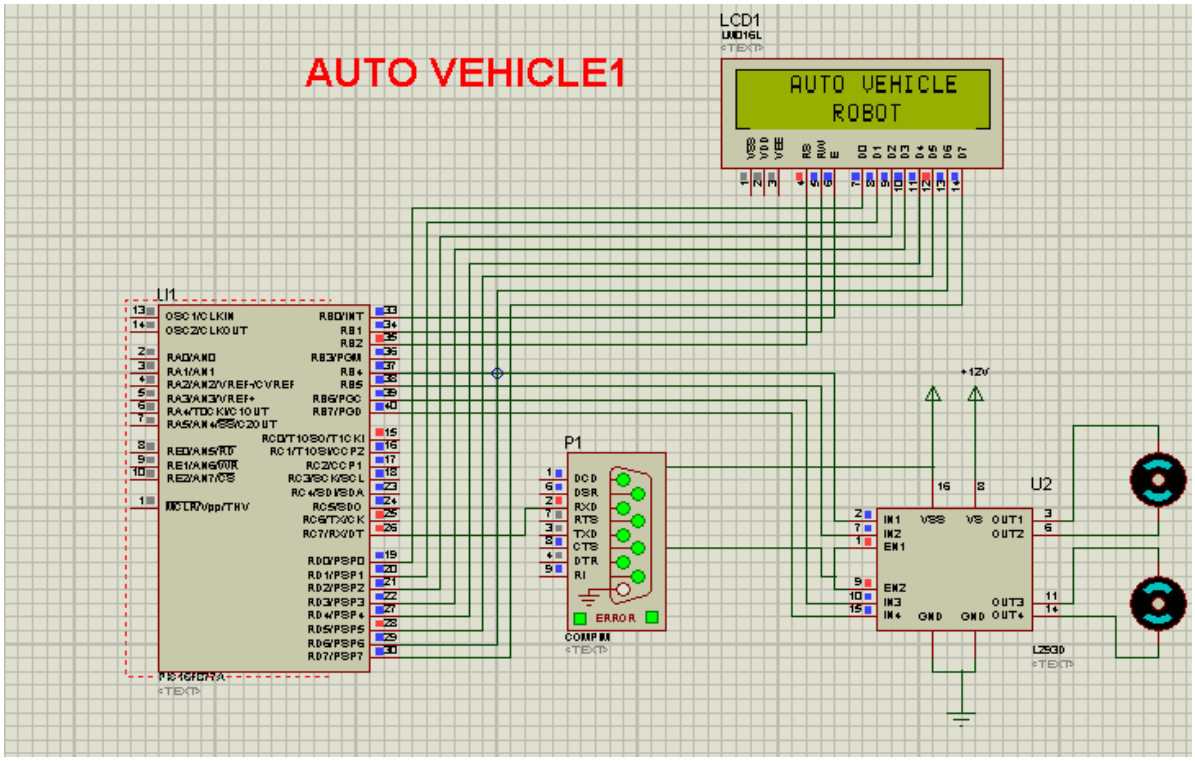


Fig 4.1 Simulation Results of our Project

V. CONCLUSION AND FUTURE ENHANCEMENT

The emergence and performance of the over trusters deserves further attention. Overtrusters ignored the vehicle route replanning functions in both control architectures, effectively over relying on the automation to manage the vehicles appropriately the over trusters, while performing the worst in terms of vehicle damage, performed better than the vehicle based performers in terms of number of targets accurately identified. Information is aggregated for presentation, operators can perform well, but this comes at a loss of control and possibly the ability to manage contingencies and unexpected situations.

A. Future Enhancement

The Proposed system design use ultrasonic sensor to sense the obstacle in V shape but in future the Ultrasonic sensor should be changed to Spherical shape. The distance here we used in our project is 1Km but in future we can use Wi-Fi for high range data transmission.

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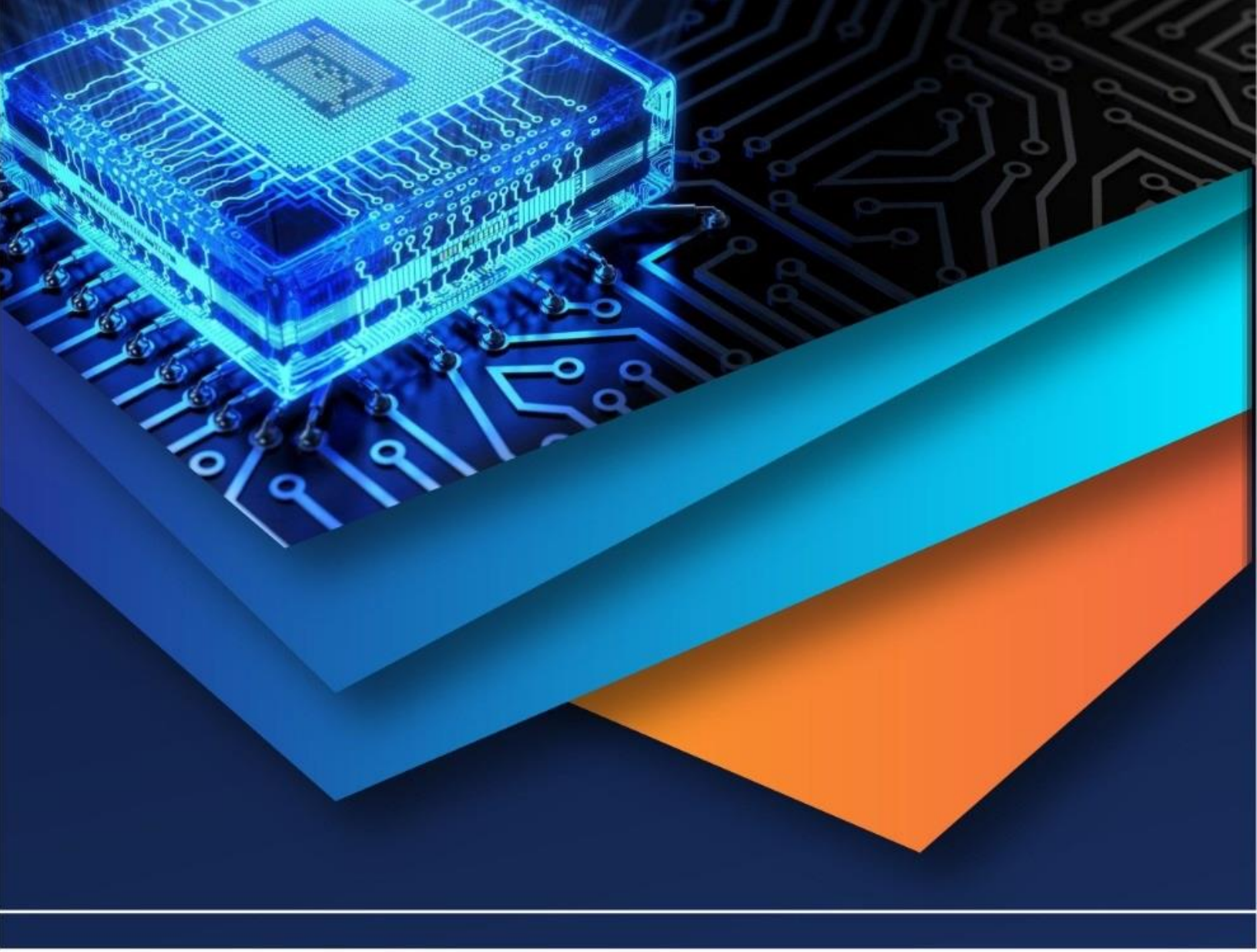

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