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# Result Paper on IOT Based Induction Motor Speed Control and Parameter Monitoring

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***Abstract:*** ***Today's application of single phase induction motor is increased due to it simple operation and availability of single phase supply in every place. The single phase motor available in different rating, Different speed and used for different application. The single induction motor is used for particular operation need to protect motor and need to control parameters of single phase induction motor and monitor this data to user operator. This is possible with help of IOT in this project single phase induction motor parameter monitoring and speed control is done through IOT base system. In this project the parameters of the motor is continuously recorded and send to the user operator through the cloud internet to end user application module.***
***Keywords: Induction Motor, IOT, Speed Control, Monitoring etc.***

## I. INTRODUCTION

Presently Induction Motor is the most common type of motor in all over fields. The invention of an induction motor by the great scientists Nikola Tesla.

About 50% of global electric power consumption is due to the induction motor. In industry 90% of uses the induction motor because of necessary characteristics such as it is inherently 'self-start' motor, it does not require permanent magnet, No brushes, No commutator rings, No position sensor. Induction motor also has a simple and robust operation, maintains a good power factor, less maintenance, highly efficient, small in size, reliable, and cheaper than another type of motor. The essential advantage part of an Induction motor is that its speed can be control easily as it has good speed regulation, sustainable overload capacity, and high starting torque. Due to all of these advantages, Induction Motor is frequently used in an all-over application like industry, electric train, electric Vehicles, crane, elevator, domestic, agriculture motors, etc .In Induction Motor number of types of fault that occur widely, it is subdivided into three most important parts such as

*1)* Electrical faults: In electrical fault normally occurs a single phasing fault, Reverse phase sequencing fault, oversupply voltage, overload fault, Earth fault, etc.
*2)* Mechanical Faults: In mechanical fault normally occurs a rotor broken bar fault, stator and rotor winding defect, Bearing fault, etc.
*3)* Environment Faults: In environment fault normally occurs the vibration of the motor, Induction Motor surrounding environment affects the performance of an Induction Motor such as moisture, temperature, etc.This paper represented IoT-based Induction Motor monitoring parameters are as voltage, current, speed, and temperature based on sensor and cloud and controlling the speed of induction motor with the help of the PWM technique as its speed can be controlled easily by controlling the input power of frequency. By continuous monitoring the parameters maintain the continuity of production in industries, making the motor reliability that is the production of an industry can be increased. Also, prevent any abnormality that takes place in the induction motor and detect the early fault in the induction motor

The specific objectives research of the thesis is as:

*a)* For safe and economic data communication in industry or any other fields, Monitoring and controlling the operation of an induction motor depends on the internet of Things (IoT) is to do.
*b)* By Early fault detection, process interruption of the motor can be reduced; also reduced damages of the motor in an industrial process to a larger extent which makes motor should be more reliable.
*c)* To protect Motor from overloading, over-current, and high temperature.

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## II. BLOCK DIADRAM OF THE SYSTEM

Below block diagram shows overall monitoring parameters and its proposed speed controlling system of an induction motor.

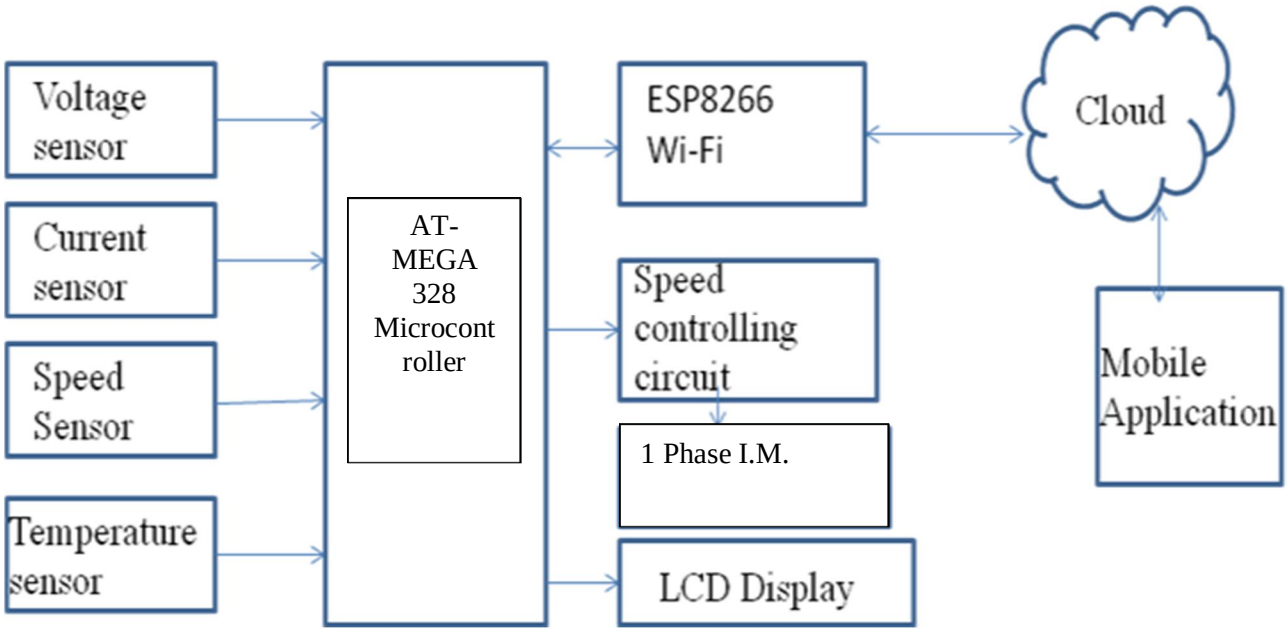



FIG. 1 Block Diagram of System

The block diagram shows four sensors for sensing the respective four parameters that are voltage (Potential Transformer), current (Current Transformer), speed (PWM Technique), and temperature (DHT-11 Sensor). with the help of that sensor monitoring the condition parameters of motor and gives the current status of induction motor to the Microcontroller and from Microcontroller through the wi - fi, the module gives information to the cloud where the information stored and from the cloud, it will receive information on mobile application whenever necessary with the help of things speak. Whatever parameter is monitored that should be displayed on LCD one by one.

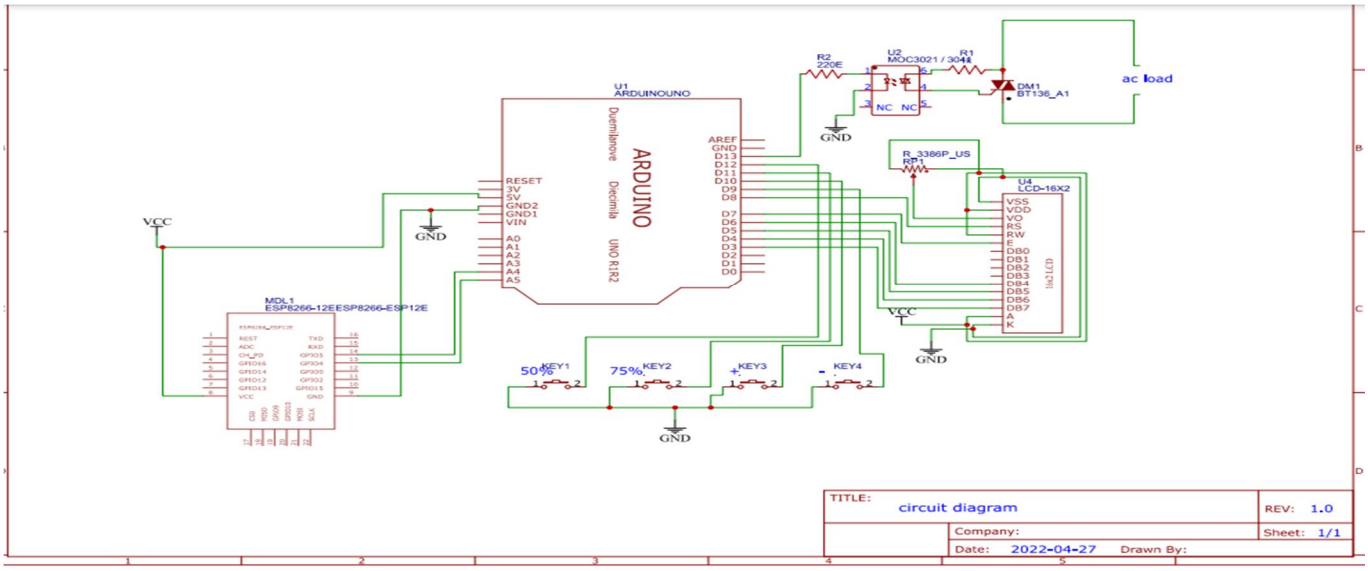



FIG. 2 Circuit Diagram of System

Above figure 2 shows the schematic circuit diagram representation of composed system. It shows point to point connection between components simulated in project.

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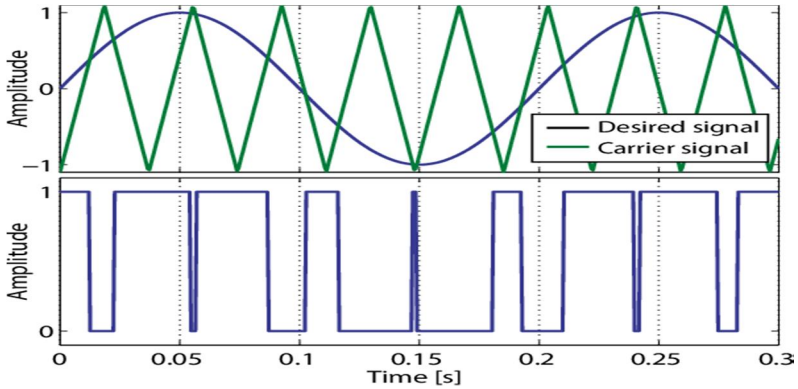


Fig. 3. Waveform representation of proposed system

## III. PWM TECHNIQUE FOR SPEED CONTROL

In this project heart of the system is an Microcontroller, for its operations required a 5v dc supply. Here for Microcontroller, get supply from step down transformer with rectifier and regulator for conversion and filter purposes used. The above diagram shows the PWM technique for speed control of the induction motor. By controlling the on-off period of Triac (Switch) voltage of the induction motor can be controlled easily, with the help of controlling the voltage speed of the induction motor that can also be controlled.

### *A. Hardware Requirement*

Following is the required component for this proposed system that is as:

*1)* Induction Motor
*2)* AT-MEGA 328 Microcontroller
*3)* ESP8266 (WI-FI Module)
*4)* Condition Monitoring Sensors
- Voltage Transformer
- Current Transformer
- Temperature Sensor
- Speed sensor

*5)* Speed controlling device
*6)* Gate Driver Circuit
*7)* LCD Display
*8)* Blynk Mobile Application

#### *1) Induction Motor*


Fig. 4. Induction Motor

The induction motor is also known as an asynchronous motor. As already knows, induction motor advantage, its necessary characteristic, robustness, and effectiveness as any other type of Motor. Here in this project induction motor is an essential part of the system.

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The following is the required parameter and the specification of an induction motor that used in this project as:

| Parameter | Specification |
|---|---|
| Volts | 230v |
| Amps | 1.50 A |
| Frequency | 50 Hz |
| Speed | 2100 rpm |
| Hp | 0.5 hp |

Table .I. Specification of an I.M Table

*2) AT-MEGA 328*

ATmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328 has 32KB internal flash memory. ATmega328 has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Some features consist of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins, programmable Serial USART, programming lock.

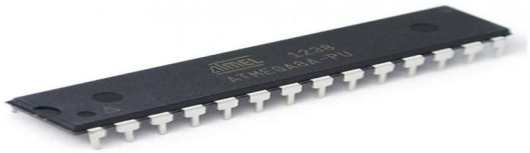


FIG.5 AT-MEGA 328 Microcontroller

*3) ESP 8266 WI-FI Module*

For communication with the cloud uses the Wi-Fi module. This paper deals with the esp8266 Wi-Fi module used for exchanging the information between devices to the cloud without connecting to any wire. Each device having itself I.P address. For connection to cloud putting I.P address on Android application, the devices in system i.e induction motor, sensors, speed controlling device connected to the cloud and sending information to cloud without any wired connection i.e through the Wi-Fi module send information for further process. Analysis and visualization can be possible by storing data information on the cloud.



FIG.6 ESP8266 WI-FI MODULE

*4) Condition Monitoring Sensors*

There are four sensors used for health monitoring and evaluation management in the system i.e. the sensors used in this proposed work system are as firstly for measuring the supply voltage uses voltage transformer it acts as a step down as well as sensing purposes of supply voltage, second is a Current Transformer for measuring motor current, the third sensor is speed controlling device ( Triac circuit ) for measuring speed and the last one is temperature sensor i.e. DHT-11 for measuring temperature and Humidity.

*a)* *Voltage Transformer:* A voltage transformer uses for measuring high alternating voltage purposes, here in this proposed system it also acts as a sensor for sensing the supply voltage of an Induction Motor. It is a step-down transformer that converts 230 v to 4 v supply. for conversion of 230 v to 4 v dc supply with rectifying and filter uses.



Fig. 7 Step down Transformer

*b) Current Transformer:* The current transformer uses for measuring high alternating current, here it also acts as a sensor for sensing the current which flows in the Induction Motor. It has an input current rating is 5A and an analog output current rating is 5mA. It is a 5A range of single-phase AC sensor module. It has 1000: 1 turn ratio. The measure application of this current sensor module is to detect overload, load drop, and shut down of the circuit.



Fig. 8 Current Transformer

*c) LCD Display:* LCD is an electronic screen display module. 16*4 type of LCD used in this proposed system for continuously displaying the monitored value of an induction motor. Here 16 values indicate the character on a single line and 4 values indicate the number of lines. For the operation of LCD required 5v dc supply. Whatever the value Display in the mobile application is the same as that on LCD hardware set up of IoT based induction motor one by one respectively.




Fig. 9 LCD Display

## IV. RESULTS AND DISCUSSION

The result of speed control in rpm, motor input power in Watt, live current of motor and live supply voltage of motor is get display on LCD display and application like phone, pc etc through the online mode as shown in observation table.

| Sr.No | Speed Control Values | Live Wattage | Current | Voltage |
|---|---|---|---|---|
| 1 | 10 | 25 | 0.52 | 229 |
| 2 | 20 | 30 | 0.64 | 229 |
| 3 | 30 | 167 | 0.88 | 229 |
| 4 | 50 | 185 | 0.93 | 229 |
| 5 | 70 | 235 | 1.14 | 229 |
| 6 | 90 | 275 | 1.25 | 229 |
| 7 | 99 | 303 | 1.32 | 229 |

Table 1. Speed Control Offline Mode via switches

| Sr.No | Speed Control Values in % | Live Wattage | Current | Voltage |
|---|---|---|---|---|
| 1 | 50% | 89 | 0.15 | 229 |
| 2 | 100% | 196 | 0.48 | 229 |
| 3 | 150% | 234 | 1.02 | 229 |
| 4 | 200% | 305 | 1.48 | 229 |

Table 2. Speed Control Online Mode via Blynk app

For the 50% of speed control motor takes 89 wattage from the supply and 0.15 amp current with voltage 229 volt.
For the 100% of speed control motor takes 196 wattage from the supply and 0.48 amp current with voltage 229 volt.
For the 150% of speed control motor takes 234 wattage from the supply and 1.02 amp current with voltage 229 volt.
For the 200% of speed control motor takes 305 wattage from the supply and 1.48 amp current with voltage 229 volt.

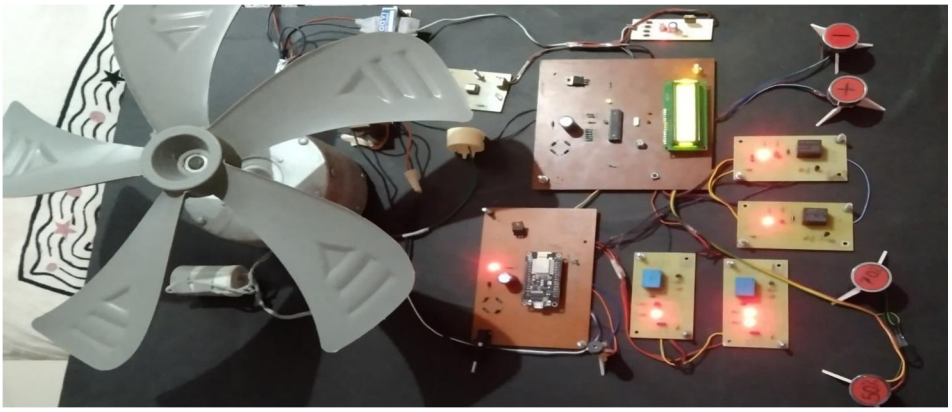


Fig. 10 Hardware set up of 1 phase induction motor model

## V. CONCLUSION

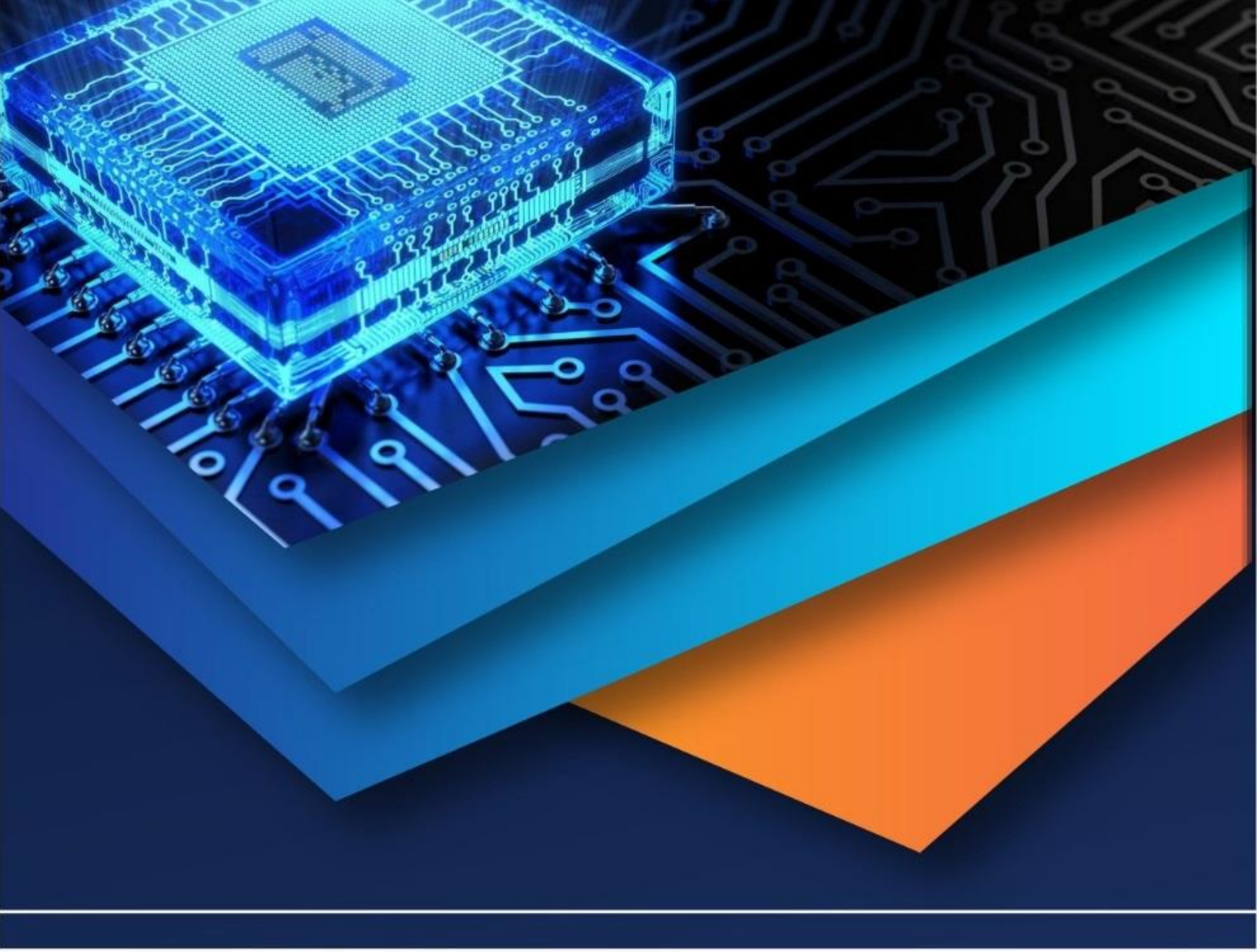
This paper represents the IoT is well known and rapidly growing technology nowadays. Now IoT becomes a vital part of human life. In the future millionaire of things should be interconnected with the cloud. Recently IoT comes all over the field such as industry, home automation, electric vehicle, traction, agriculture, medical field, etc. with the help of sensors this paper represents IoT-based condition monitoring parameters and controlling the speed of the motor with the help of PWM techniques. Analysis and visualize voltage, current, speed, and temperature parameters on an LCD display. By analyzing the motor parameters make the motor to be operated in safe and protective in nature, It also helps in calculating new data to interact with social media and other devices. From thing speak visualization the waveform of voltage, current, temperature, and speed on the mobile application by connecting to hotspot module. In industries required continuous monitoring data value for power consumption and maintenance application.

## VI. FUTURE SCOPE

In the future lot of scope is there for IoT applications. Worldwide wide all overuse the IoT application for human life sophisticated. In 2025 millions of things connect to the cloud. A lot of research also done on IoT and it's more uses for human life's easiest purpose. Some research works on defense services for security and surveillance, some on automatic vehicle control and traffic signal control, some on the medical field for body control and health care, some on electronic devices, smart home, etc.

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