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Home automation using IOT application

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ABSTRACT
The **concept of Home Automation** aims to bring the control of operating your everyday home electrical appliances to the tip of your finger, thus giving user affordable lighting solutions, better energy conservation with optimum use of energy. Apart from just lighting solutions, the concept also further extends to have a overall control over your home security as well as build a centralised home entertainment system and much more.
The **Internet of Things** (or commonly referred to as IoT) based Home Automation system, as the name suggests aims to control all the devices of your smart home through internet protocols or cloud based computing.
The IoT based Home Automation system offer a lot of flexibility over the wired systems s it comes with various advantages like ease-of-use, ease-of-installation, avoid complexity of running through wires or loose electrical connections, easy fault detection and triggering and above and all it even offers easy mobility.

I. INTRODUCTION

The home automation is control of home device form a central control point automation is today's facts where more things are being completed every day automatically. Usually the basic tasks of turning on or off certain device and beyond, either remotely or in close proximity. The concept of the RF-based system is to use the underlying wireless data network such as IEEE 802.11 (Wi-Fi). The popularity of wireless networks at home has increased in recent years, and the advanced computer technology has made the personal digital device to commonly have the capability to communicate through the wireless network.

Thus IoT based Home Automation system consist of a servers and sensors. These servers are remote servers located on Internet which help you to manage and process the data without the need of personalised computers. The internet based servers can be configured to control and monitor multiple sensors installed at the desired location.

The internet of things (IOT) is the network of physical objects or "Things" embedded with electronics, software, sensors and network connectivity, which enable these objects to collect and exchanging data. IOT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunity for more direct integration between the physical world and computer based system, and resulting in improve efficiency, accuracy and economic benefits.

II. CONTENTS

Hardware description

ESP8266: Presently ESP8266EX is a chip with which manufacturer are making wirelessly networkable micro-controller modules. ESP8266EX delivers highly integrated Wi-Fi SoC solution to meet users' continuous demands for efficient power usage, compact design and reliable performance in the Internet of Things industry. With the complete and self-contained Wi-Fi networking capabilities, ESP8266EX can perform either as a standalone application or as the slave to a host MCU. When ESP8266EX hosts the application, it promptly boots up from the flash. The integrated highspeed cache helps to increase the system performance and optimize the system memory. Also, ESP8266EX can be applied to any microcontroller design as a Wi-Fi adaptor through SPI/SDIO or UART interfaces. ESP8266EX integrates antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules. The compact design minimizes the PCB size and requires minimal external circuitries. Besides the Wi-Fi functionalities, ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor and on-chip SRAM. It can be interfaced with external sensors and other devices through the GPIOs. Software Development Kit (SDK) provides sample codes for various applications.

The modules: Various vendors have consequently created a multiple of modules containing the esp8266 chip at their cores. Some of these modules have specific identifiers, including monikers such as "Wi07c" and "ESP-01" through "ESP-13",

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while other modules might be ill- labelled and merely referred to by a general description- e.g- "ESP8266 wireless transceiver". ESP8266 based modules have demonstrated themselves as a capable, low-cost, networkable foundation for facilitating end point IOT developments. ESPressif's official module is presently the ESP_wroom-02 [4]. The AI thinkers are succinctly labelled ESP-01 through ESP-13. NODEMCU boards extended upon the AI-thinkers modules. Olimex, ADAfruit, SPArkfun, WEmo

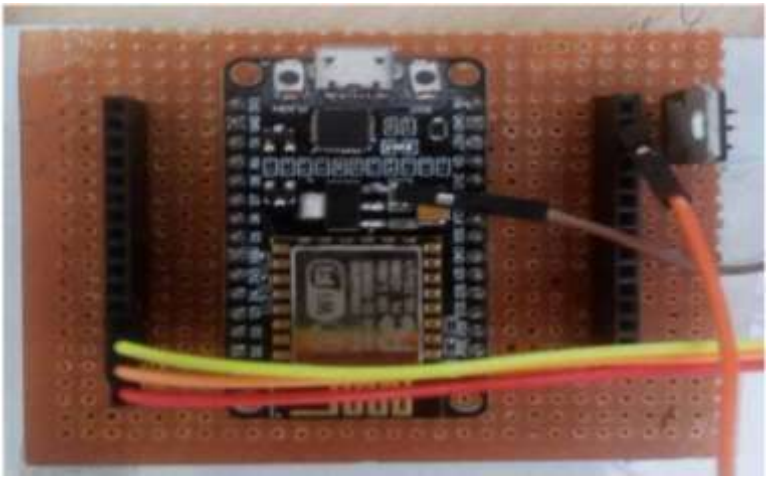

Figure 1. Circuit Connections of ESP module 8266

Relays:A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices. In fact, some of the first computers ever built used relays to implement Boolean gates. In this article, we will look at how relays work and a few of their applications. Relays are amazingly simple devices. There are four parts in every relay. Electromagnet, Armature that can be attracted by the electromagnet, spring, Set of electrical contacts which is shown in figure 2 & 3.

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands.

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Figure 2. Types of relays

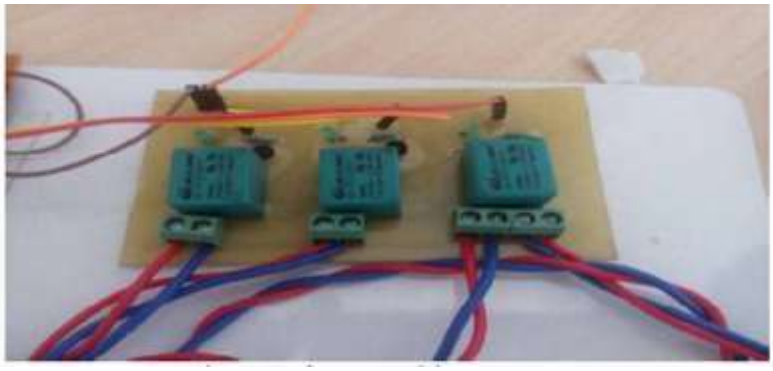

Figure 3. Relays used in prototype

The specification of relays are as follows Input supply 12 VDC @170ma,Output four SPDT relay, Relay specification 5A@ 230VAC,Trigger level 2-5 VDC,PCB dimensions 88mm × 68mm. Four mounting holes of 3.2mm. LED on each channel for relay status. Load of the relays are 7A @ 230-250 VAC,10A @ 120 VAC,10A @ 24 VAC.D2.D4.D6.D8 : relay on/off led indication in figure 4.

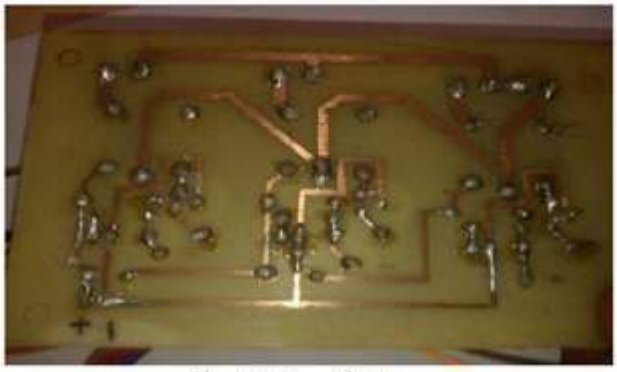

Figure 4. Relays pin setup

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III. DESIGN & IMPLEMENTATION

In the project we embedded the ESP8266 Wi-Fi module with sugar cube relays to control devices wirelessly or from particular distance. Here we use hotspot configurations, that to achieve our project goal, first of all we create a hotspot channel to connect other devices and so ESP8266 .Then when we configure the correct IP address which is generated by the software "Arduino.ide" for the other devices to connect. Remember the IP will be same cause the ESP module system is stable so the IP is always same [5].Here we use diodes in the circuitry of sugar cube relay arrangements to prevent the damages of back EMF which is generated by the coil of relay's inner circuitry. The capacitors used to stable the charge for coil to stay in set state .

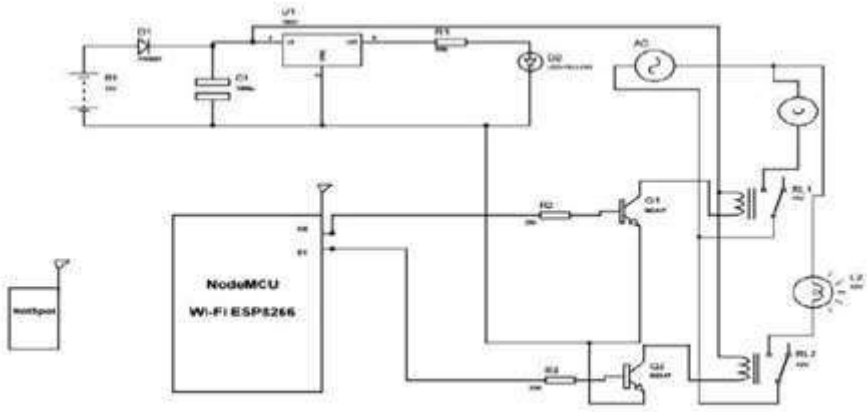

Figure 5. Overall circuit diagram

IMPLEMENTATION :-

Generally, a smart home uses smart devices to automate and control household functions—often through mobile apps and voice commands.

...

1. Choose your first smart device. ...
2. Choose your smart home platform. ...
3. Connect more devices. ...
4. Create routines and automations.

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. and shown in figure 6. The editor has National Conference of Communication systems and Advance Computingfeatures for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port.

The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor in figure 7.

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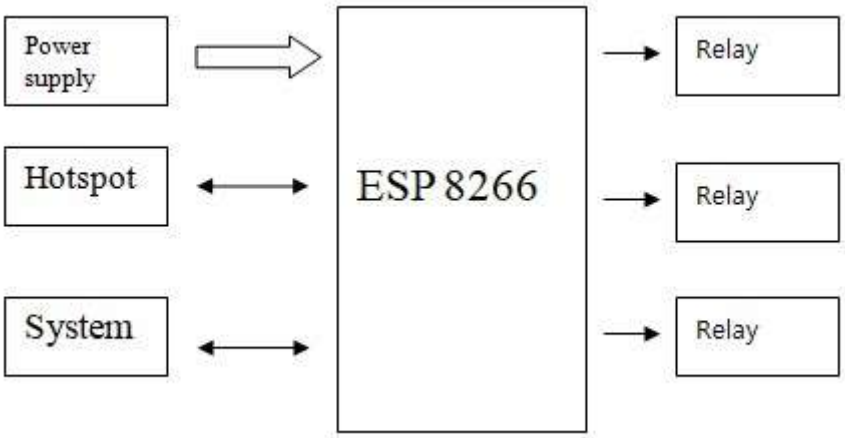
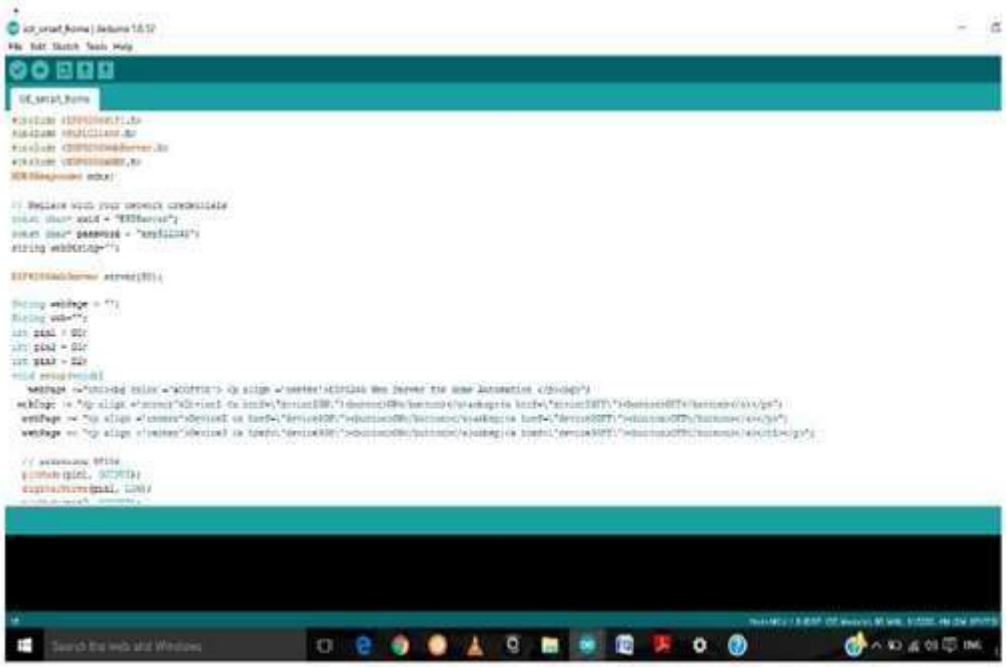
Block diagram:-



The purpose of a home automation system is **to streamline how your home functions**. Consider some of these benefits: Remote access: Control your home from mobile devices, including your laptop, tablet, or smartphone. Comfort: Use home automation to make your home a more comfortable, livable space.

RESULTS IN MATLAB:-



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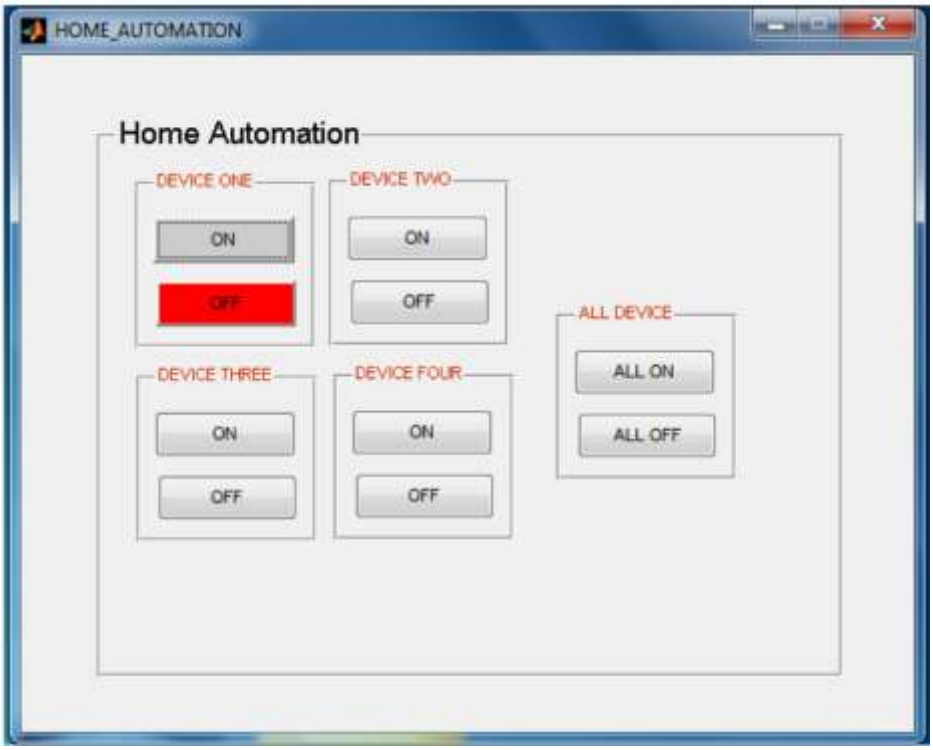
```
function varargout = HOME_AUTOMATION(varargin)
% HOME_AUTOMATION M-file for HOME_AUTOMATION.fig
%      HOME_AUTOMATION, by itself, creates a new HOME_AUTOMATION or raises the existing
%      singleton*.
%
%      H = HOME_AUTOMATION returns the handle to a new HOME_AUTOMATION or the handle to
%      the existing singleton*.
%
%      HOME_AUTOMATION('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in HOME_AUTOMATION.M with the given input arguments.
%
%      HOME_AUTOMATION('Property','Value',...) creates a new HOME_AUTOMATION or raises the
%      existing singleton*.  Starting from the left, property value pairs are
%      applied to the GUI before HOME_AUTOMATION_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property application
%      stop.  All inputs are passed to HOME_AUTOMATION_OpeningFcn via varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help HOME_AUTOMATION

% Last Modified by GUIDE v2.5 18-Nov-2016 16:39:58

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @HOME_AUTOMATION_OpeningFcn, ...
                   'gui_OutputFcn',  @HOME_AUTOMATION_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
```

Screenshot of GUI for Home Automation System:-



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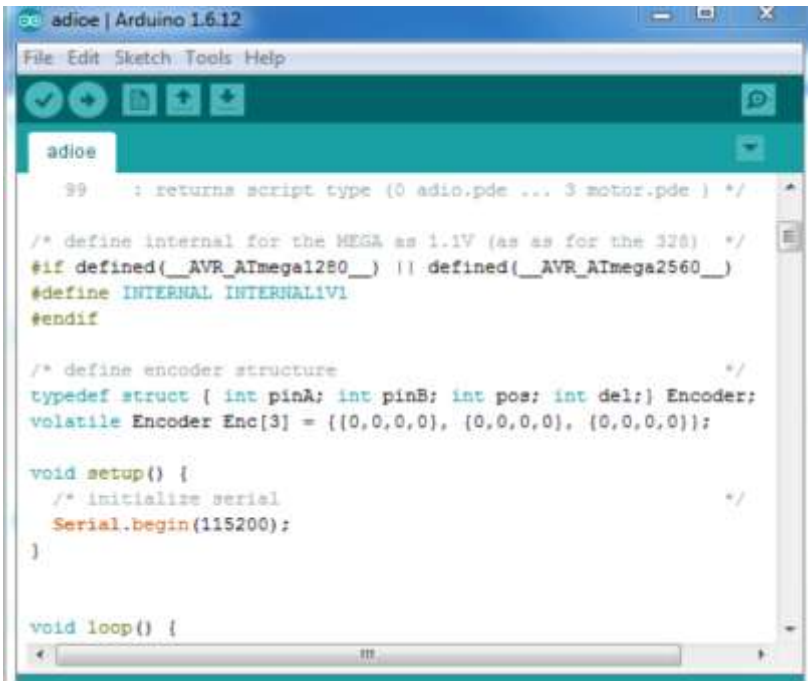

Screenshot of initialization in Arduino Code for Matlab controlled Home Automation System

Figure 6. Software simulation on arduino IDE

Figure 7.

IV. FUTURE SCOPE OF HOME AUTOMATION

Home of the future is a space for the digital natives. With the invention of lots of automation technologies featuring IOT and AI, home automation has become a reality. One can implement several of their tasks with just a single command of verbal instructions. These technologies can used to build fully functional home automation system and control smart home devices including smart lights, connected thermostats, and appliances.

There are several new technologies which can become a part of home in the near future:

- **Increased efficiency, control, and customization**: Artificial intelligence is set to make you lazy in the near future. Technology will become much more efficient and one will be able to control everything from volume to security from one central place. The devices

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will work automatically and you don't need to waste your energy it will act upon user's preferences. AI would revolutionize home by automatic threat detection and proactive alertness.

- **Integration of Smart home devices**: One can command it to control small things of home through voice and Smartphones. All the tech giants are working in the field of IoT to bring advancements in the home automation devices. In near future, homes will be equipped with such IoT devices which will make your daily lives work faster smoother and more accurate.
- Mark Zuckerberg came up with a goofy proof-of-concept video showing off an idealized version of how his Jarvis system actually works. Google Home, which is Google's smart speaker loaded with Google Assistant, was updated at last year's Google I/O with a bunch of new features, including "proactive assistance", also known as push notifications, hands-free free calling, Spotify, SoundCloud, and Deezer integrations, and more. Also, more recently, Google launched two more Google Home speakers, Home Max and Home Mini.

- **Smart spaces outside homes**: Smart parking through sensors will help to recognize whether the parking is available or not. Camera monitoring can be done and with the help of artificial intelligence and computer vision, both parking facilities and security can be provided. It would be a faster and smoother process and act as a reference for other smart systems to be build accordingly. Streetlights can also be automated through sensors and build for effective use for the people nearby.

- **Development of smart appliances**: The devices which we use to use like television, refrigerator and even the mirror is getting smarter today with evolution of technology. The smart mirror should not only act as a face video but also help to other tasks like listening to music and stuff. Televisions have become part of a centralized entertainment and can also be used for social media. The refrigerator has been upgraded to sense the temperature outside and operate accordingly. The washing machine will wash the clothes according to the clothes material and switch off after drying. They will keep on advancing as the technology evolves.
- **Personal home delivery**: Drones will be used to deliver the packages at the right time. They will replace the normal salesman job. They might also be used for several other tasks like monitoring the weather outside the home, returning something back to a relative's home nearby and so on. They can also be used for monitoring the traffic in our locality.

One can build several amazing projects using the concepts of home automation. There are several projects already done by developers and available on the Internet. They might help you to start the work with IoT. You can add new skills to own smart device. You can make your smart home device work according to your life works and habits. Even we can build many projects around it by discovering new areas of the internet of things and make the world a smarter place to live in.

Advantages
- Error probability reduced Ease of access and low cost and power consumption
- Can reduce human effort
- Smarter processing and services
- Can be implemented at any device and automated
- Alert system is quick in case of an emergency
- Eliminates the use of PC for automation
- Helps old age people to control the remote devices
- Simple interface

Disadvantages
- Replacing humans is dangerous May take time and learning
- Security concerns
- Vulnerable to attacks
- Most of the times range is restricted
- High dependency on sensor devices which makes the system vulnerable if sensor fails

CONCLUSION :-

The IoT device market has undergone radical changes in only a few short years. Starting with disparate devices and no ecosystems to speak of, the market has now grown to encompass enterprise players working together to create ecosystems, tailored for mobile technology, which allows IoT devices to become interconnected.

Automaton of the home may have once seemed like a peculiar and unlikely concept, but as our devices become smarter and more investment is poured into the development of ioT consumer products, we are likely to see increased competition spur on further innovation in the field.

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