

A Smart Home - Voice Recognition Based Home Automation

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Abstract— The Automation of the surrounding environment of a modern human being allows increasing his work efficiency and comfort. There has been a significant development in the area of an individual's routine tasks and those can be automated. With the increase in population, there is a grave need to conserve energy in every way possible. The inability to access and control the appliances from remote locations is one of the major reasons for energy loss. The proposed system contains the design of the low cost voice recognition based home automation system namely 'Smart Home'. It controls various home appliances and communicates with devices using internet. It automates the things like; relay based electric switches which controls the operation of various appliances like lights and fans. It helps to sense the temperature and secure home with locking systems. This Automation system will communicate with the user through voice input known as voice recognition and also with the web interface. The voice recognition system will work on the voice commands given by user from his/her voice training set. Upon successful recognition of the voice command, the IoT system then drives the corresponding modules. This project presents the automated approach in controlling the devices of a household which eases the task over the traditional method of using a switch. A web and a voice recognition application is used by the users to give instructions to these systems. The most famous and efficient technology for better wireless communication i.e, WiFi, GSM or Bluetooth are being used here to automate the system. The Smart Home includes voice based interaction with devices which can ease to operate the things or appliances like Light & fan controls, temperature and security controls.

Keywords: WiFi, GSM, Bluetooth, Home Automation System, Development board, Sensors, Voice Recognition, Relay modules, Switches.

I. INTRODUCTION

The world has turned into a worldwide because of insurgency in the innovation in this unrest the IT (Data Technology) assumed a critical part. Correspondingly the upset in IT makes thought come consistent with have a robotized home. Home automation framework utilize microchip base to coordinate or control electronic items and frameworks in the home. The motivation behind Voice controlled home automation is proficient usage of power. That is the reason many sorts of inquires about and numerous arrangements had proposed on home automation. These frameworks utilize PC, versatile internet[6], GSM ,Bluetooth[5] and ZigBee arrange and so on. Home computerization is regular thing in western nations yet it is not that much use in INDIAN area, the fundamental purpose for this is its high cost. So we attempt to make this venture as temperate as conceivable to actualize in nearby region. It is an altogether different idea than what is by and by

accessible in market. This would make mechanization all the more simple and basic. The individuals will have the capacity to connect with the framework easily. It is an exceptionally valuable venture for the grown-ups and physically incapacitated people, who are not ready to do different exercises efficiently. Human make oversights and neglected to turn off the apparatuses when there is no utilization and for this situation, they are valuable so as to use the power successfully and furthermore in a secured way.

The demography of the total populace demonstrates a pattern that the elderly populace worldwide is expanding quickly subsequently of the expansion of the normal future of individuals. Home automation is one of the real developing enterprises that can change the way individuals live. Some of these home computerization frameworks focus on those looking for extravagance and complex home mechanization stages; others focus on those with exceptional needs like the

elderly and the crippled. The point of the revealed Voice Controlled Home Automation" is to give a framework that can react to voice charges and control the on/off status of electrical gadgets, for example, lights, fans, TV and so forth, in the home. The framework ought to be sensibly shoddy, simple to arrange, and simple to run. An incorporated stage for home security, observing and computerization by utilizing microcontroller. The framework ought to be associated with a LCD screen, which would give the client current framework status. So that the client can without much of a stretch control the machines. The client ought to have the capacity to control every one of the machines from any point in their home, so a remote controller ought to be given.

An average remote home automation framework permits one to control house hold apparatuses from a brought together control unit which is remote. These apparatuses ordinarily must be uncommonly intended to be good with each other and with the control unit for most monetarily accessible home automation frameworks. The venture shows a framework that can be coordinated as a solitary compact unit and permits one to remotely control lights, fans, ventilation systems, TV, and so forth, and kill on or any machine that is connected to a divider outlet. The general framework is controlled from an advanced cell application. This sends the voice orders in twofold grouping to microcontroller. This is finished by utilizing a Bluetooth module. The microcontroller unit takes choice and play out the required choice.

II. INTERNET OF THINGS

The Internet of Things is a novel outlook change in IT coliseum. The expression "Internet of Things" which is likewise in a matter of seconds surely understood as IoT is authored from the two words i.e. the main word is "Internet" and the second word is "Things". The Internet is a worldwide arrangement of interconnected PC organization that utilizes the standard Internet convention suite (TCP/IP) to serve billions of clients around the world. It is a system of systems that comprises of a large number of private, open, scholastic, business, and government systems, of nearby to worldwide degree, that are connected by a wide exhibit of electronic, remote and optical systems networking technologies [1]. Today more than 100 nations are connected into trades of information, news and sentiments through Internet. As indicated by Internet World Statistics, as of December 31, 2011 there was an expected 2, 267, 233, 742 Internet clients around the world. This means 32.7% of the world's aggregate populace is utilizing Internet. Indeed, even Internet is going into space through Cisco's Internet Routing in Space (IRIS) program in the coming fourth years.

The Internet of Things speaks to a dream in which the Internet stretches out into this present reality grasping regular items. Physical things are no more disengaged from the virtual world, however can be controlled remotely and can go about as physical access focuses to Internet administrations.

An Internet of Things makes figuring really pervasive – an idea at first set forward by Mark Weiser in the mid 1990s [2]. This advancement is opening up tremendous open doors for both the economy and people. In any case, it likewise includes dangers and without a doubt speaks to colossal specialized and social challenges.

The Internet of Things vision is grounded in the conviction that the substantial advances in microelectronics, interchanges and data innovation we have seen as of late will proceed into the not so distant. Truth be told – because of their decreasing size, continually falling cost and declining vitality utilization – processors, interchanges modules and other electronic segments are as a rule progressively incorporated into regular protests today.

III. LAYERS OF TECHNOLOGY

The Internet has been in presence for more than forty years and the term 'Internet of Things' has been used subsequent to the extensive scale appropriation of RFID started 10 years prior. So what is making this new fervor about IoT? There are a few/several factors. Today you have minimal effort however very capable sensors, and advances in wired and wireless communication technology and network conventions that allow you to better associate sensors to the Internet. You have a variety of devices, platforms, and analysis strategies that can procedure a lot of sensor information and present important experiences. You can send information and get bits of knowledge through different gadgets, for example, your cellular telephone, a tablet on your fridge, your car, or you're PC. A nearby association amongst things and people, the digital world and the physical world, has in this manner been set up by means of sensors and gadgets. What's more, that is the reason the potential for change is immense. Each industry will make new plans of action and offer new administrations to clients with the Internet of Things.

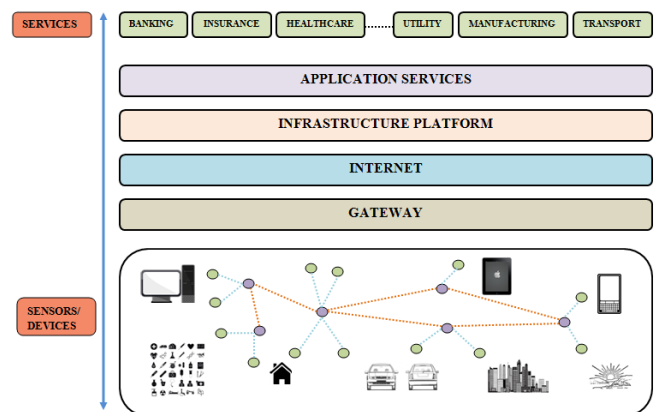


Fig 1: Layers of technology help IoT drive transformations to the business

As of now, IoT administrations and services are to a great extent that is given by gadget manufacturers. In any case, organizations need to draw in with various gadgets and applications. By what means can such complexity be taken care of? We trust that a solid spine that empowers numerous

functions is vital to the delivery of IoT services. In the event that your organization needs to offer sensor based administrations, for example, human services checking, or help your vehicle and logistics office follow vehicles or packages, you require a stage that permits **device monitoring, application development and data management** [1] and Fig 1 represents these stages. If there are value added services – such as analytics - on top of these that would be a boon.

DEVICE MANAGEMENT

An IoT platform ought to have the capacity to give you a chance to connect to various devices and oversee them remotely. Whether you are following a profitable resource on your shop floor, a wearable medicinal services gadget, or a vehicle, you should arrange the device and run firmware updates. You ought to likewise have the capacity to work with the different programming applications that identify with the device. You ought to have the capacity to guarantee device security and its access to partners. The platform should likewise allow you to screen the device availability and wellbeing, and run reports. From a useful standpoint, information accumulation from IoT devices is critical. Information from the device might be gathered or questioned intermittently, on-interest, on a planned premise or in view of 'events'.

APPLICATION MANAGEMENT

Your business may have various IoT related applications, and you may also invite third parties to host apps. For application and information administration, you require features that permit compelling client administration and asset provisioning, application life cycle administration, procurement for application modeling, and generation of code.

SENSOR DATA ACQUISITION AND MANAGEMENT

The core of your IoT application is sensor information. A stage's APIs ought to permit sensors, devices, portals, intermediaries, and different sorts of customers to enlist sensors in the framework and after that embed sensor perceptions. The platform must be exceedingly versatile since the number and sort of sensors you may utilize and the perception capture rate may turn out to be substantial over a timeframe. You might run various applications identified with your sensor based devices. It is essential to have entry to your information and to have the capacity to deal with your application database on the platform. When you have a pack of applications running on the platform, tremendous volumes of information begin streaming in to understand the capability of an IoT platform you require analytics to mine the information and offer bits of knowledge. Analysis could incorporate everything from customary Business Intelligence (BI) to data mining, machine learning, statistical processing, predictive analytics, and time series analysis on stored sensor information. Ongoing analysis on sensor streams incorporate rule based processing, complex event processing, pattern detection, correlation, and the sky is the limit from there. You

ought to have the capacity to offer bits of knowledge to end-clients as rich perception. Aside from standard diagrams, bars, and outlines, sensor information might be overlaid on top of maps or exhibited in contraptions or infographics. Representation services might be given by means of GUI based devices or APIs, or both.

IV. EXISTING SYSTEM

The **GSM based Home Automation System** proposed in [1] provides 3 means to control the home, the GSM network, the Internet and through speech. The real time monitoring has been an important feature that can be used in the home automation systems. As a change in the status of the devices occurs, the user can be informed in real time. The user commands are transferred to a server which is usually done by a PC. The server processes the user commands and sends them to the relevant units. This can help control the appliances. GSM is used as a communication medium to help establish connection in places where there may not be proper internet connectivity. The server uses AT commands to communicate with the GSM modem. The mobile interface is developed using J2ME. The server has 4 engines running – the web server, database, main control program and speech recognition program. The system can be controlled using SMS. It can send confirmation messages. Speech processing is done with a dynamic time wrapping algorithm. The voice activation has been tested and found to be too impractical. As a more stable alternative, the voice input can be activated through a wireless unit the user carries along in the house. Each application node has four parts – the transmitter, receiver, I/O device and a microcontroller. The main control program in the server takes status information from the devices' transceiver in real time.

The system makes use of a PIC16F887 microcontroller for home appliances control [2]. It makes use of GSM for control of the appliances. This is an SMS based system. GSM has been used due to its high availability, coverage and security. The control of home appliances is done primarily through SMS codes. AT commands can be sent through the GSM network and this controls the home devices. Messages are Osent by the device to the user through SMS as well. This system can however incur additional costs for the SMS. There is no UI that the user can use to control the device. This system has the drawback of not being able to program the devices. Also SMS depends on the networks and there is a possibility of delayed delivery. The system does not does not have any state information related to the devices and expects the user to keep track of it. The system [3] is described as an M2M system. It uses GSM for communication. GSM offers options for M2M which include Dual Tone Multi Frequency (DTMF), SMS and General Packet Radio Service (GPRS). This system chooses to use the SMS along with AT (attention) commands. It has a PC as a centre of commands. A GSM dial-up and communication system is embedded in the PC. Visual C++ is used for implementation. The PC decodes the received messages via SMS and performs the commands required. It is

a system that can be programmed for the required application as per requirements. The system also has the ability to control mechanical appliances, through sensors that convert electrical to mechanical signals. However, this system is not designed to provide feedback to the user.

The system is PC centric and requires the PC to be on all the time. It cannot be used as a real time control system. The home server is built upon a SMS/GPRS mobile cell module and a microcontroller [4]. This allows the user to monitor and control any appliances at home using any Java enabled cell phone. The paper presents the design and the system makes use of a PIC16F887 microcontroller for home appliances control [2]. It makes use of GSM for control of the appliances. This is an SMS based system. GSM has been used due to its high availability, coverage and security. The control of home appliances is done primarily through SMS codes. AT commands can be sent through the GSM network and this controls the home devices. Messages are sent by the device to the user through SMS as well. This system can however incur additional costs for the SMS. There is no UI that the user can use to control the device. This system has the drawback of not being able to program the devices. Also SMS depends on the networks and there is a possibility of delayed delivery. The system does not have any state information related to the devices and expects the user to keep track of it.

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source. The main drawback of this system is that it relies heavily on the SMS, which is not very fast and dependable. There can be delays in delivery. Also security of the system is compromised since passwords are sent freely over the network.

Bluetooth Based Home Automation framework makes utilization of a phone and Bluetooth innovation. Bluetooth innovation is secured and ease. It makes utilization of an Arduino Bluetooth board. An intuitive python program is utilized as a part of the PDA to give the UI. The I/O ports of the Bluetooth board and transfers are utilized for interfacing with the gadgets which are to be controlled. The Bluetooth is watchword secured to guarantee that the framework is secure and not abused by any interlopers. The Bluetooth has a scope of 10 to 100 meters, 2.4 GHz data transfer capacity and 3Mbps speed. The python application on the telephone is versatile. It is additionally a quick and financially savvy framework. There is an analytic framework that can distinguish issues in the hardware. An input framework will report status of gadgets after each flag flip. The primary downside as for Bluetooth is that it requires a long investment to find and get to gadgets in its region. It doesn't give vitality protection tips. Ongoing access can't be accomplished. Anyplace access to the gadgets can't be accomplished. Get to is constrained to inside the Bluetooth extend.

Bluetooth innovation is utilized to control home apparatuses. The customer is a PC that is associated by means of USB to the Bluetooth module, sensor circuit and a heartbeat width adjustment circuit. Sensors and actuators are utilized to control the circuit. The Bluetooth module that is associated with it will permit it to get different charges by means of Bluetooth. Bluetooth gadgets can check and distinguish different gadgets effortlessly. It may likewise be conceivable to check whether gadgets are working legitimately or not. The framework likewise has a brightening sensor that can turn on lights when outer light is dull and a temperature sensor. This framework likewise experiences the downside of the scope of Bluetooth being around 10 meters as it were. This framework has the upside of having the capacity to fit onto a current framework. There is likewise minimal effort required in this framework.

Phone Based Home Automation is one of the few frameworks that are portrayed as an empowering framework that can be utilized to give a typical structure to home Automation. It gives a framework to a brilliant home that incorporates offices, for example, a framework controller, house wide wiring and a typical interface. This will empower utilizing the current framework for home mechanization. An equipment based remote controller for power point control has been depicted [12]. The capacity of this remote controller is to control the power provided to gadgets at a remote area. The framework utilizes the phone line for transmitting the orders. The controller is a rationale framework constructed altogether of equipment. It wipes out the cost acquired with microcontrollers. It utilizes a DTMF handset which is interfaced with a strong state hand-off to control the power

supply. It could likewise be executed tentatively with infra red signs and AC control line bearer innovation.

A home computerization framework makes utilization of the double tone multi recurrence (DTMF) utilized as a part of phone lines [13]. The framework as appeared in figure 3 utilizes the standard open exchanged phone lines. There are three segments in the framework. The first is the DTMF collector and ring indicator. The second part is the IO interface unit. The third part is the PC which does the online operations. The PC identifies the ringing of the line and after that verifies the client. After this the client will be permitted to utilize the keypad tones to control the gadgets as required. A case of stepper engine control is taken up. This framework has the benefit of being secure and permitting global institutionalization. This is on the grounds that the DTMF tones are a similar everywhere throughout the world. Be that as it may, it experiences the downside that the quantity of apparatuses is constrained by the quantity of keys in the keypad. A conventional telephone for the most part has 12 keys as it were.

The **ZigBee Based Home Automation** helps in remote correspondence innovation can be connected [14] for home automation. The framework utilizes PIC microcontroller and voice acknowledgment for this reason. The voice charges are taken from a mike. They are contrasted and a voice store and prepared. The PIC microcontroller then transmits the orders through ZigBee to the collector. The beneficiary unit has another PIC microcontroller that can procedure the order. It utilizes transfers to control the separate apparatuses. This framework has the downside that ZigBee is a low range correspondence medium. So remote get to is ruined from far away areas. Likewise, the voice acknowledgment module could get to be distinctly clumsy. This framework has the additional component of incorporating a smoke locator to the framework. At the point when smoke is detected, it makes an impression on the client's implicit portable number.

V. PROPOSED SYSTEM

The proposed model of the home automation system is as shown in the figure2. The proposed system contains the design of the low cost voice recognition based home automation system namely 'Smart Home'. It controls various home appliances and communicates with devices using internet.

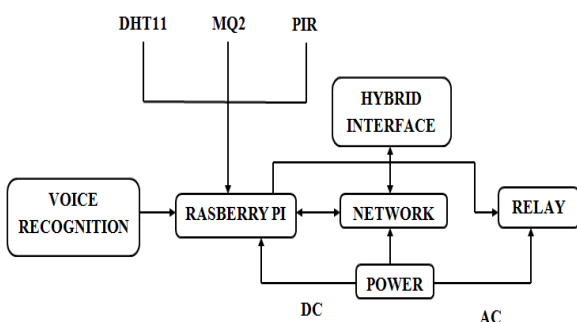


Fig 2: Block Diagram for Voice based Home Automation System

- **DC Power:** To run the raspberry pi
- **Network:** To access the raspberry pi within the intranet or internet
- **Voice recognition:** To access the devices using voice commands.
- **AC Power:** To supply power to the appliances.
- **Appliances:** Light, Fan, etc..
- **PIR:** A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. Generally we use this PIR sensor to detect the objects, particularly humans.
- **MQ2:** A gas detector is a gadget that identifies the nearness of gasses in a zone, regularly as a major aspect of a wellbeing framework. This kind of gear is utilized to recognize a gas spill or different discharges and can interface with a control framework so a procedure can be consequently closed down. A gas finder can sound an alert to administrators in the range where the break is happening, giving them the chance to clear out. This kind of gadget is imperative on the grounds that there are numerous gasses that can be destructive to natural life, for example, people or creatures.
- **DHT 11:** A humidity sensor senses, measures and consistently reports the relative mugginess noticeable all around. It gauges both dampness and air temperature. Relative mugginess, communicated as a percent, is the proportion of genuine dampness noticeable all around to the most astounding measure of dampness air at that temperature can hold. The hotter the air is, the more dampness it can hold, so relative stickiness changes with variances in temperature. Generally we utilize this sensor to detect the room temperature.
- **Relay:** A relay is an electrically worked switch. Many transfers utilize an electromagnet to mechanically work a switch, however other working standards are additionally utilized, for example, strong state transfers. Transfers are utilized where it is important to control a circuit by a different low-control flag, or where a few circuits must be controlled by one flag. The main transfers were utilized as a part of long separation broadcast circuits as intensifiers: they rehashed the flag rolling in from one circuit and re-transmitted it on another circuit. Transfers were utilized broadly in phone trades and early PCs to perform sensible operations. Relays are utilized where it is important to control a circuit by a low-control motion (with finish electrical detachment amongst control and controlled circuits), or where a

few circuits must be controlled by one signal [3]. In our framework the yield from raspberry pi 3 is specifically provide for hand-off circuit. On the off chance that GPIO stick is High then relating transfer will turn on and makes it's gadget working. We are utilizing a NPN transistor in transfer and it works in light of idea of emf. The transfer can be chosen by our application reason.

VI. RASPBERRY PI 3

The Raspberry Pi 3 board model B has a processor of 1.2 GHz 64-bit quad-center ARMv8 CPU and 1 GB RAM which practically acts like a small PC [1]. A raspberry pi 3 board has 802.11n remote LAN and Bluetooth 4.1. We introduced Raspbian Jessie[2] in the memory card utilized for the board. Raspberry Pi 3 has a LINUX based working framework call Raspbian. There are additionally 40 GPIO pins which can be utilized as both computerized input, advanced yield and to control and interface with different gadgets in this present reality, 4 USB ports, 1 HDMI port, 1 Ethernet port, 1 3.5mm Audio jack, smaller scale USB control supply. This board likewise has serial associations for interfacing a camera (CSI) and a show (DSI).



Fig 3: Raspberry Pi Board

The Raspberry Pi is a progression of credit card-sized single-board PCs created in Wales, United Kingdom by the Raspberry Pi Foundation with the aim of advancing the educating of fundamental software engineering in schools and creating nations. The first Raspberry Pi and Raspberry Pi 3 are fabricated in a few board designs through authorized assembling concurrences with Newark element14 (Premier Farnell), RS Components and Egoman. The equipment is the same over all makers. The Raspberry Pi 3 is the third era Raspberry Pi. Contrasted with the Raspberry Pi it has:

- A 2.4GHz quad-core ARM Cortex-A53 CPU
- 1GB RAM
- 4 USB ports
- 40 GPIO pins
- Full HDMI port
- Ethernet port
- Combined 3.5mm audio jack and composite video

- Camera interface (CSI)
- Display interface (DSI)
- Micro SD card slot
- Video Core IV 3D graphics core
- Inbuilt WiFi
- Inbuilt Bluetooth

Since it has an ARMv7 processor, it can run the full scope of ARM GNU/Linux disseminations, including Snappy Ubuntu Core, and also Microsoft Windows 10 (see the blog for more data). The Raspberry Pi 3 has an indistinguishable shape element to the past (Pi 1) Model B+ and has finish similarity with Raspberry Pi 1. Raspberry Pi 3 Model B offers more adaptability for learners than the leaner (Pi 1) Model A+, which is more valuable for installed activities and ventures which require low power

VII. RESULTS AND OBSERVATIONS

Voice based home automation system deals with controlling of appliances and communication with the appliances with the usage of internet.

Fig 4 represents the mode in which all the appliances of a room are displayed. The user can select the necessary appliance from the option to control the appliances connected in a specified room.

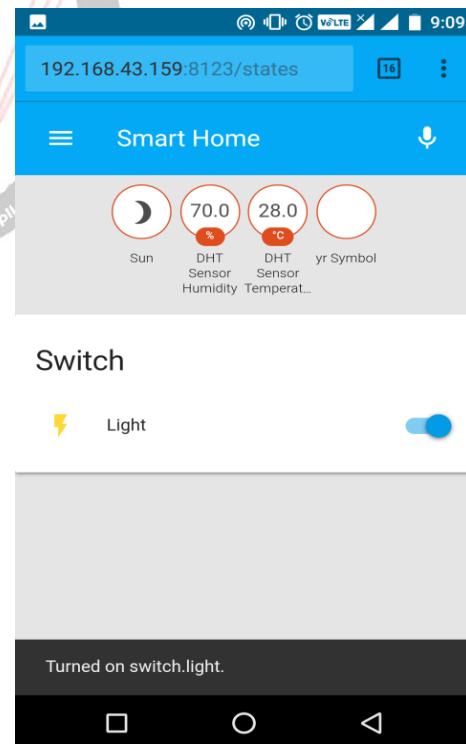


Fig 4: Switch mode activity I

Fig 5 and 6 represents the mode that provides the user with on/off buttons to control the required home appliances using voice control.

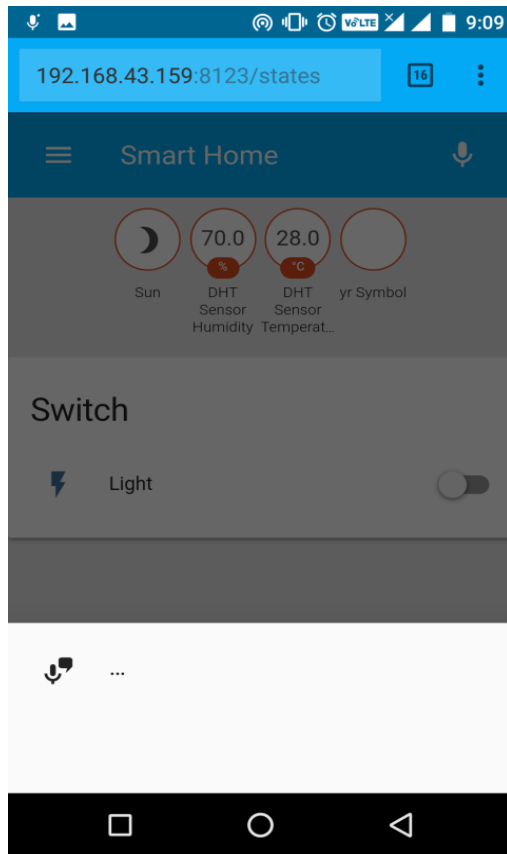


Fig 5: Switch mode activity II

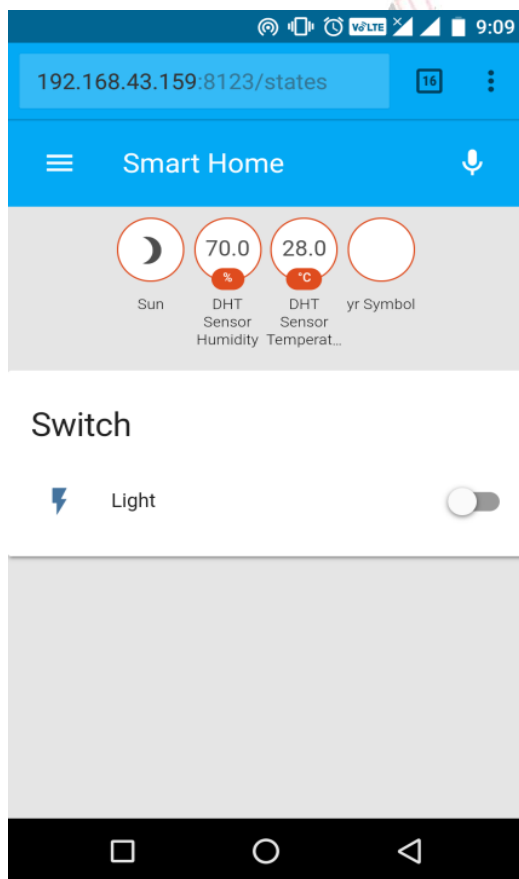


Fig 6: Switch mode activity III

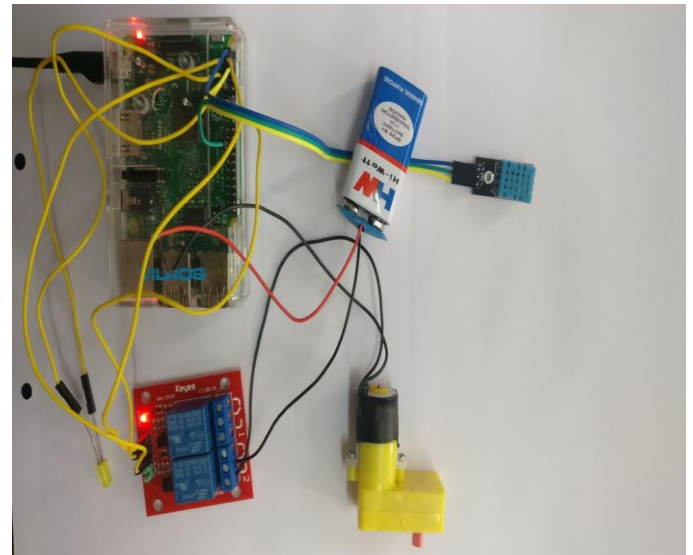


Fig 7: Circuit representation of voice based home automation system

This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home. Household appliances can be easily controlled via a Mobile/Tablet. Status of light, fan and other electrical appliances can be known. This helps to provide security.

VIII.CONCLUSION

Voice Controlled Home Automation is an altogether different idea than what is directly accessible in h showcase. This would make mechanization all the more simple and instinctive. The general population will have the capacity to communicate with the framework. It additionally is a vital viewpoint in the present world where individuals are so occupied; this would help them in facilitating the essential usefulness of their life. Our general surroundings are going computerized in each viewpoint we can envision and it is going on quick, we likewise need to push ahead with it. Our framework is an awesome activity venture in computerization, it would likewise give security. As it depends on voice acknowledgment we can appoint specific secret key to every client and the computerization will react to the right passwords as it were. Easy to use, reduction of unnecessary power consumption, low cost compared to other automation systems, ease of implementation, provision of high security measures, better processing power and ability to handle multiple functions at the same time, usage of reliable wireless connection, provision for security and personal customization are the accompanying dominant features of our framework.

Fig 7 represents the the circuit representation of the voice based home automation system.

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