IOT Based Smart Home Automation

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Abstract : Home automation exists since many decades for controlling basic equipment of home like the lights and simple appliances. The IoT allows objects to be sensed and controlled remotely over existing network infrastructure, creating opportunities for pure integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy, and economic benefit in addition to reduced human intervention. In home automation, all home appliances are structured and the networked together and able to operate without human involvement. The aim of paper is to design and construct a home automation system which will switch on or off any household devices that are connected to it, using microcontroller and android based application. It is socially relevant, and its implementation is cost effective. Home automation gives a significant change in humans life which gives smart operating of home appliance. As Renewable energy grew at a rate faster than any other time in history during this period. In this work, solar panels used as the source of power for the equipment. This controlling is done through Arduino, Relays, Sensors and smart monitoring using android based application. This helps the user to control the switching of the devices with the help of app using IOT.

Index Terms: *IOT, Home automation, Arduino, Relays, Sensors, Solar panels.*

I. Introduction

"Home automation" refers to the automatic and electronic control of household features, activities, and appliances. The utilities and features of our home can be easily controlled via Internet. There are three main elements of a home automation system: sensors, controllers, and actuators. Having day to day developing technology is a proud moment to the whole world. The foremost aim of the technology is to increase the efficiency and to decrease the effort. In this trending world, Internet of Things is being given extreme importance. In that, Automation, leads to have less effort and much efficiency. By using IoT, we are successful in controlling the appliances in various areas, in which one of them is to control the home automation by using Node Microcontroller. We can also use other boards like raspberry pi, beagle bone etc. Even though the technology is developing in our day-to-day life, there is no help coming into existence for the people who are physically not good based on technology. As the speech enabled, home automation system deploys the use of voice to control the devices. It mainly targets the physically disabled and elderly persons. The home automation will not work if the speech recognition is poor. The speech given by the user will be given as input to the Microphone. Microphone recognizes the speech given by the person and sends it to the recognizing module. It searches for the nearest word even if there are any disturbances in it. If the command (ON/OFF) is given, the action is done. Home is the place where one desires to be rest after a long tiring day. People come home exhausted after a long hard-working day. Some are way too tired that they find it hard to move once they land on their couch, sofa or bed. So, any small device/technology that would help them switch theirs lights on or off or play their favourite music etc. on a go with their voice with the aid of their smart phones would make their home more comfortable.

II. Literature survey

Tan, et.al.[1] proposed the development of an Internet-based system to allow monitoring of important process variables from a distributed control system (DCS). This paper proposes hardware and software design considerations which enable the user to access the process variables on the DCS, remotely and effectively. Potamitis, et.al.[2] suggested the use of speech to interact remotely with the home appliances to perform a particular action on behalf of the user. The approach is inclined for people with disability to perform real-life operations at home by directing appliances through speech. Voice separation strategy is selected to take appropriate decision by speech recognition. Ciubotaru-Petrescu, et.al.[3] presented a design and implementation of SMS based control for monitoring systems. The paper has three modules involving sensing unit for monitoring the complex applications. A processing unit, that is microcontroller and a communication module that uses GPRS modem or cell phone via serial port RS-232. The SMS is used for status reporting such as power failure. **Anamul Haque,et.al.[4]** proposed a system entitled "A System for Smart-Home Control of Appliances Based on Time and Speech Interaction" that controls the home appliances using the personal computer. This system is developed by using the Visual Basic 6.0 as programming language and Microsoft voice engine tools for speech recognition purpose. **Jawarkar, et.al.[5]** proposed remote monitoring through mobile phone involving the use of spoken commands. The spoken commands are generated and sent in the form of text SMS to the control system and then the microcontroller on the basis of SMS takes a decision of a particular task. Ramani, R [6] emphasized on Certainties period is web of things (IOT) which has won immense notoriety and notoriety during these current years. What's to come is web of things, that will also have the transformation ability of genuine latent gadgets into virtual worldwide hubs. The IoT endeavours to achieve unification of the entire thing in our worldwide underneath a typical framework, this may never again help us to profit control anyway likewise actualize records symmetry. The high objective of this paper is to give a recognition into web of things, designs, and basic innovation and their product in our day-by-day life. With the entry of IT and ITeS innovation has caused an unrest in presence at character arrange notwithstanding authoritative running stage. Vinay Sagar, et. Al.[7] worked on IOT smart home automation, there were 4 most important demanding situations confronted by the home automation gadget these days; those demanding situations encompass: excessive price of ownership, inflexibility, terrible manageability, in addition to issue in reaching security. the principal objectives of this mission is to layout and implementation of a home automation system the usage of internet of things technology, that is able to automating and controlling maximum of the daily appliances within the residence thru an clean and manageable net interface. The machine recommend on this paper, has a notable adaptability of using wi-fi technology for interconnecting of the allotted sensors to home automation machine server, on the way to in the long run is to reduce the cost of deployment at the side of growing the upgrading capacity and device reconfiguration. **Khunchai [8]** presented a low-cost smart home system with an efficient system. The hardware consists of Node MCU Arduino, PIR sensor, temperature

sensor, light dependent resistor and a motion sensor in IP Camera. The software includes ArduinoIDE and MIT app inventor II for Android mobile phones. The system developed based on Android user Interface for controlling a smart home. The NETPIE platform, which is a network of IoT, is used for interfacing between a user and a smart home.

III. Methodology

The methodology followed in this current work has been described in figure 1

DATA COLLECTION

CONCEPT GENERATION

SELECTION OF COMPONENTS

DESIGN

FABRICATION OF COMPONENTS

TESTING

ERROR RECTIFICATION
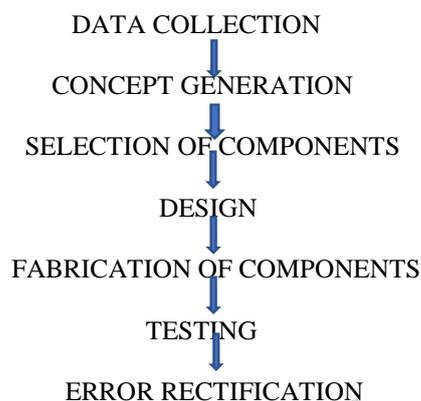
Figure 1: Chart flow of IOT based Smart Home Automation

IV. Experimental Details

Arduino: Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments as shown in figure 2.

Figure 2: Arduina Mega

LCD: A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power as shown in figure 3.

Figure 3: LCD

Relay: A relay system is basically a bunch of switches (Like light switches or the switch fuse in the box) except instead of your hand to flip it back and forth it is controlled by software (or other sources) as shown in figure 4.
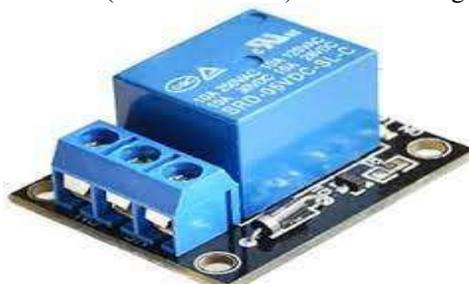
Figure 4: Relay

HC-05 Bluetooth Module: The HC-05 can be set as Master as well which enables making a communication between two separate Arduino Boards. There are several different versions of this this module, but we have used that comes on a breakout board because in that way it's much easier to be connected. The HC-05 module is a Bluetooth SPP (Serial Port Protocol) module, which means it communicates with the Arduino via the Serial Communication as shown in figure 5.

Figure 5: HC-05 Bluetooth Module

Temperature sensor: A temperature sensor is a device, typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature as shown in figure 6.
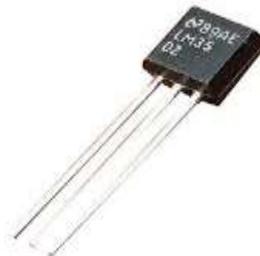
Figure 6: Temperature sensor

Solar panel: Solar panels are those devices which are used to absorb the sun's rays and convert them into electricity or heat. A solar panel is a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect. These cells are arranged in a grid-like pattern on the surface of solar panels as shown in figure 7.

Figure 7: Solar panel

V. *Working Principle of Developed Model*

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. we need to connect the module to the Arduino Board. This module can be powered from 3.6 to 6 volts, because it comes on breakout board which contains a voltage regulator. However, the logic voltage level of the data pins is 3.3V. So, the line between the Arduino TX (Transmit Pin, which has 5V output) and the Bluetooth module RX (Receive Pin, which supports only 3.3V) needs to be connected through a voltage divider in order not to burn the module. On the other hand, the line between the Bluetooth module TX pin and the Arduino RX pin can be connected directly because the 3.3V signal from the Bluetooth module is enough to be accepted as a high logic at the Arduino Board. Now we are ready to connect the smartphone to the Bluetooth module and the Arduino. What we need to do here is to activate the Bluetooth and the smartphone will find the HC-05 Bluetooth module. Then we need to pair the devices and the default password of the HC-05 module is 1234. After we have paired the devices, we need an application for controlling the Arduino. There are many applications in the Play Store for this purpose which will work with the Arduino code that we wrote using the MIT App Inventor online application. Temperature Sensor is connected to the Analog port of the Arduino [11-15]. The output of the sensor is in linear form. The formula in the code converts the analog reading into the degrees Celsius. PIR sensor is Passive Infrared Sensor. It comes in a fully assembled package and is connected to the I/O pin of the Arduino. It is used for motion detection. Light Sensor is made to work using a LDR (Light Dependent Resistor), whose output is given to the analog port. The analog voltage is used to determine the day light intensity. Smoke sensor can be place in kitchens or in workshops to detect the gas leakage. The sensor is connected to the analog port. The LCD (Liquid Crystal Display) is connected to the I/O pins. LCD is used to display the real time data of the sensors. To monitor the status of the sensor the Bluetooth module (HC-05) is used and connected to the serial communication port of the microcontroller. The android phone has an application to communicate with another Bluetooth device. This type of software has been used to control the operation and monitor. The energy consumption in home areas is greater as

more home equipment's are used. For solving this home energy problem, we consider energy saving through renewable sources. With the help of solar panels energy generation is done. The HC-05 module is a Bluetooth SPP (Serial Port Protocol) module, which means it communicates with the Arduino via the Serial Communication. And further connected to relays to control the home appliances.

VI. Results and Discussion

In this project, voice commands as well as manual commands are given to through MIT app. In this home automation, user have given commands through MIT smartphone app. Home appliances like Bulb, Fan Motor, Water pump and AC etc., are controlled according to the given commands. The commands given through the MIT app are decoded and then sent to the microcontroller and it control the relays. The device connected to the respective relay turned On or OFF as per the user's request. The microcontroller used is Arduino Mega and the communication between the microcontroller and the application is established via Bluetooth module. When the command is given from the MIT app to ON the light, fan it sends response to Arduino and which sends signal to relays (5V) to switch on the respective connected device that is bulb and turn ON the bulb and the fan. The output for MIT app-controlled Home automation as shown in figure 8.

Figure 8: Controlled light and fan rotation

VII. Conclusions

A novel architecture for minimal cost and adaptable home Automation framework utilising Arduino Microcontroller is proposed and executed. Since Arduino is easy to understand & its coding is easy. By implementing this type of system, we can ensure that the energy conservation can be done by using solar panel for electricity generation. As to save the energy cost we used renewable energy source. The energy consumption includes the energy uses of home equipment's and Energy generation is based on solar panel. Hence by taking both consumption and generation, the home server optimizes home energy use. By help of this system, we can increase the efficiency of the appliances. We can have the complete control over the home appliances.

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