

IoT Based Home Automation System

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Abstract— Home Automation system is one of the important needs of today’s era. It consists of a smart lighting system, load Diversity system and, safety features. This is microcontroller- based technology used for two-way communication in safety features, sensor feedback in a smart lighting system. This home automation system is crucial as the consumption of electrical energy will reduce. This is IOT based project consist of sensors, timer circuits, and other electrical equipment. The circuitry is controllable utilizing inputs given by the sensors and the expected output action is taken by using microcontroller NodeMCU. This NodeMCU is a multitasking microcontroller use to perform various tasks. As it is IOT based we can operate it through mobile and other communication devices this is the main advantage of the system. For that purpose, we are using cloud service provided by Ubidots. The demand for automation in all the field is increasing day by day and home automation has a huge scope in the future.

Keywords - Home automation; IoT; NodeMCU; ESP8266 microcontroller; Cloud platform.

I. INTRODUCTION

The unnecessary use of electricity is a big problem in households or even in big organizations. The Lights of the room are kept ON even if no one is there in the room, due to this a huge amount of electricity is wasted. Any of the authorities does not consider this loss as a big loss as this takes place at the consumer’s end and consumers pay for the same. But if this electricity is saved then it can reach the consumers which are away from the benefits of electricity. Along with electricity, the security of the house is a big challenge which is being faced nowadays. Incidents of robbery are frequently taking place. To tackle this problem some solution needs to be found out which would help house owners to continuously monitor their houses and give them security from robbery and other such incidents. A large number of appliances are used in the household that consumes a large amount of electricity and one needs to know the amount of electricity consumed by a specific appliance so that he can use it according to and save electricity. Also, in big organizations or factories, many machines are there which consume a large amount of electricity, as companies are charged different tariff depending upon peak hours and OFF peak hours.

In this project, these three aspects are covered. To overcome the problem of electricity Consumption illumination control of light bulb is used. In this, the illumination of the bulb will vary depending on the

amount of the light in the room. For this purpose, an LDR sensor is used to detect the intensity of light in the room. This LDR is interfaced with NODE MCU which is a microcontroller that has an integrated WIFI module in it. Further, its connection is given to the bulb whose illumination is to be controlled. The Bulb is connected to 230V single-phase supply voltage. If the intensity of light in the room is ample enough then the bulb will be off and according to will be increased or decrease depending on the intensity of light. Further, the security of the room can be improved by using sensors like IR sensor, MQ2 sensor, LM393sensor which helps us to monitor the door-opening and closing. A BO motor is used which operates the opening and closing of a door. In Load Diversity system with the help of network time protocol (NTP) which will be used to fetch real- time values and according to preset values of time i.e.at off- peak hours the load will be turned on. Along with this, we have to use relays for further operation. In this project, we are using a cloud service provided by UBIDOTS .By using this dashboard, various other parameters can be monitored and controlled from remote locations.



Fig. 1. Model of the system

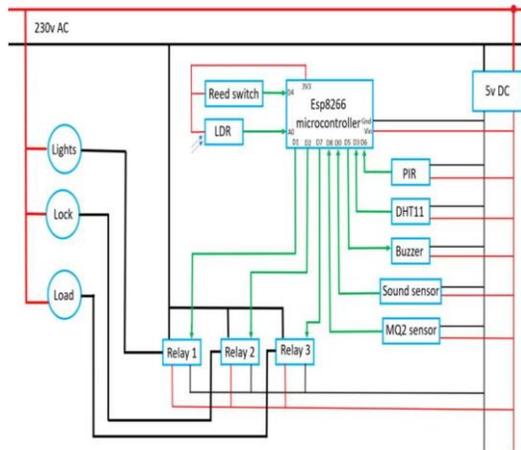


Fig. 2. Single Line Diagram

II. PROBLEM STATEMENT

Though the loss of electricity at the household end may not look severe but may save a lot of energy if taken into consideration. The electrical energy which is wasted in the form of a light bulb can be saved can be used for any new application. Whereas the security of the home needs to be insured in today's era of new technology. Along with this different types of load and their consumption is a major factor for consuming electricity.

III. LITERATURE SURVEY

When it comes to energy conservation there are several some many methods, but none of the methods is so effective other than improving P.F in case of industrial loads. But energy conservation is crucial for residential loads also. There are several factors on which we can work to reduce consumption. We have to do some modifications to the system so that we can use electrical energy efficiently. We named this an "IOT based home automation system". Following are the functions combined in this system to reduce electricity usage by controlling illumination and other parameters.

A. Illumination Control

Here in this we are going to use a number of sensors like PIR sensors, LDR sensors to sense the human presence and turning the light on or off accordingly. The LDR sensors are provided to each bulb so that the illumination can be controlled. As this is IOT based technology the illumination is controlled through the Wi-Fi module of the mobile itself. Ultimately the input current to the bulb is changing for controlling the

illumination as per need. In this way, we are doing energy conservation. The other components required for this proposed system are the NodeMCU microcontroller, relays, Wi-Fi module. The Wi-Fi module of the microcontroller is used for two-way communication i.e. we can give commands as well as receive through it.

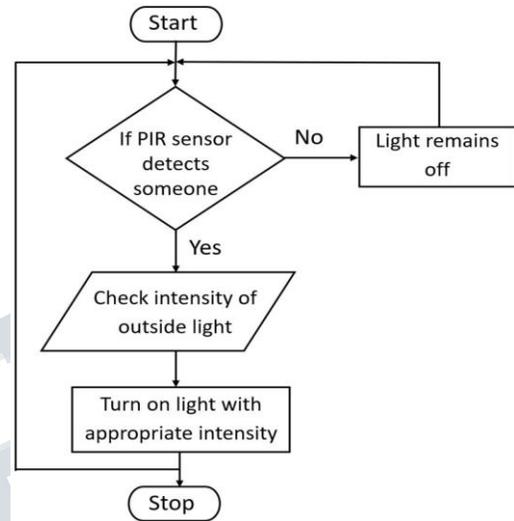


Fig. 3. Flowchart for Illumination Control

B. Security System

As this is a home automation system the security features are also added to it. For that purpose, DHT11 sensors, MQ2 sensors, and PIR sensors are used. These sensors have their significance. MQ2 sensors are used for detecting the presence of flammable gases like LPG. DHT11 is a temperature and humidity sensor that will sense the temperature up to 50 degrees Celsius. PIR sensor is used to detect human motion. For each sensor, the relay is provided so while operating the relay coil will energize. The buzzer is provided for alarming purposes. Reed switch is another component that will respond when it is kept near the magnet used to monitor the door so we need not worry about the door whether the door is properly closed or not. These all components combine to form the circuits for a security system.

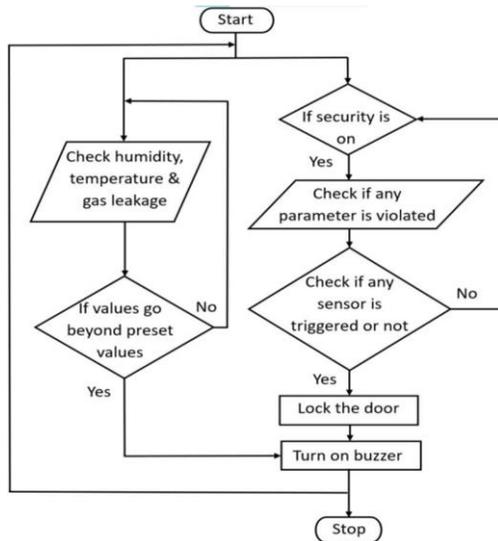


Fig. 4. Flowchart for Security System

C. Load Diversity

Another important feature we have added is load diversity. This is for the effective use of electrical energy. This is the function by using which, heavy loads can be made to operate in off-peak hours only. The timings of off-peak hours will be stored in the system by using a cloud platform. Relays are provided to cut off the supply whenever they are needed. Period time of off-peak hours will be stored on the cloud platform. So, we can have a whole record of usage. Relays are programmed in such a way that they will allow heavy loads in off-peak hours to avoid excess charge given by MSEDCL. This is very beneficial from the consumer point of view.

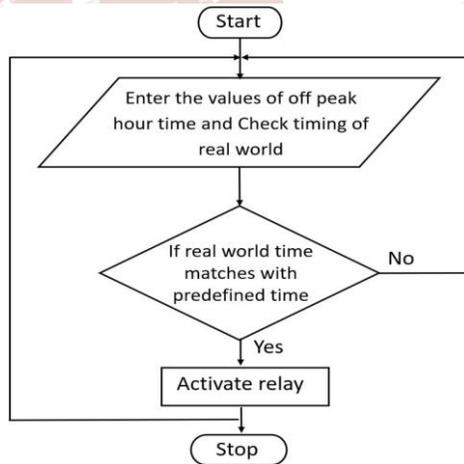


Fig. 5. Flowchart for Load Diversity

IV. BLOCK DIAGRAM

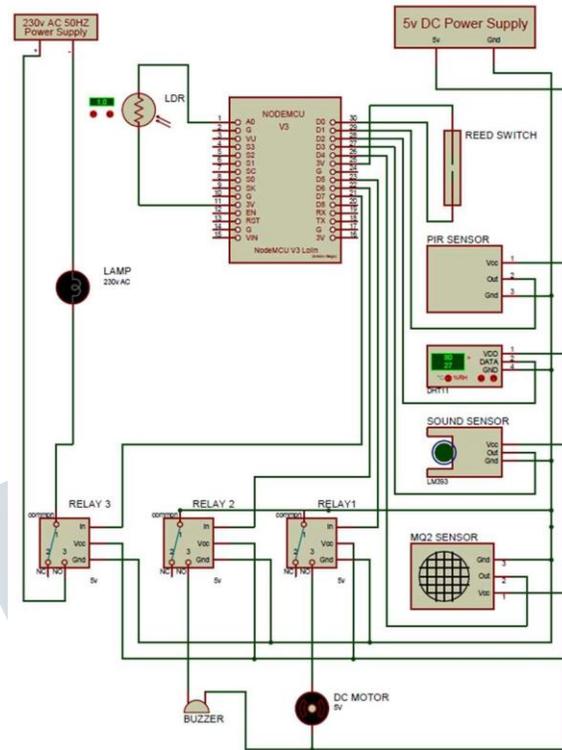


Fig. 6. Block Diagram

V. CURRENT RESEARCH

Recently the work is going on load diversity where the load becomes on only at off-peak hours. This is much effective for industrial loads because they consumption more energy for a longer time than the domestic consumer as well as when the tariff rates are more. The time at which the maximum load is required is essential for the electricity tariff. So, we need to use the huge loads in off-peak hours only. By doing this we can reduce the electricity bills. For implementing load diversity, we can use network time protocol (NTC) which will use to fetch real-time values and according to preset values of time i.e. at off-peak hours, the load will turn on. Along with this, we have to use relays for further operation. In this, we have to take the inputs from NTC to node MCU and the relay coil is energized as per the signal received from the microcontroller. So further loads connected through relays will operate. This project is not only limited to domestic or mechanical industries we can use it in other sectors like agriculture, pharmaceutical, automobile, etc. By selecting proper sensors and their programming we

can automate any sector and make it efficient. This project has huge scope because it can be an option for PLCs used for automation. But the advantage of using microcontroller-based automation is the price because all the components used here are available at a cheaper rate as compared to PLCs.



Fig. 7. Cloud Dashboard

VI. RESULT

By using the functions of Illumination and load diversity, electricity consumption can be reduced. Thus, it will result in a decrease in electricity bills. Also, the intensity of the lights can be varied according to the daylight automatically. Security feature helps to prevent any mischief by alerting the user and locking the home. The Locking mechanism can be activated automatically or manually. Other parameters like temperature and gas leakage will be monitored constantly which will help to prevent any accidents. In addition to this, because of the cloud platform, using cloud HMI (fig. 7), this system can be controlled and monitored from remote locations. The estimated cost for this product is ₹3,500 which is quite fair and not so much expensive as far as home automation

is concerned. So, it serves one of the goals to make a device affordable for everyone.

VII. CONCLUSION

Every nation has diverted its focus toward energy conservation which will directly help to conserve natural diversity. This project focuses on the consumer end where every individual can contribute toward the conservation of energy. After implementing this not only energy conservation can be done but also consumers can save a lot amount of money which they waste unknowingly.

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