

Energy Monitoring System

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Abstract- *The smart energy monitoring and security system is a highly efficient and reliable concept that is used to measure electricity, water level and gas level at our homes. In today's world most of the people are looking forward to reduce the energy usage and to reduce the cost for the usage of energy. They are looking towards to reduce the costs in an any possible way. More over the people are looking to make their surroundings more automated to reduce the work. Thus, they will use systems that can reduce work even if is small. Today in most homes the electricity usage is increasing and simultaneously the electricity bills increase. The people are trying to reduce the electricity bills through the known ways. Our system can be useful to reduce the electricity bills in a low cost and efficient way. The system can also find the further usage and its tariff through machine learning It system can also monitor the water level which reduce the task to look towards the water tank to find the amount of water inside the tank. Its system can also monitor the gas amount in gas cylinders because in most of the homes the people cannot know the gas amount so that they cannot book another gas cylinder before it gets empty. Our system also consists of a security system which can identify the person's image and can compare with the images stored in the database through artificial intelligence which can have better security than normal cctvs. By using this system, the security can be tightened in an cheap and efficient way. All the components and working can be monitored through an android app and led screen. Thus, the people can easily know all values easily.*

Keywords- Artificial Intelligence, Machine Learning, Face Recognition, Automation

I. INTRODUCTION

As we all know that the whole world is suffering from power surge, there need to be some preventive methods to reduce the use of electricity. For that there need to be a system that helps to monitor the electricity rate. Nowadays almost everything is possible using our Smartphone. Our electricity monitoring helps to analyse the power usage at our homes using a mobile app. The monitoring system also helps to reduce electricity bill.

In Kerala the tariff for the electric units is different for different sets of units. The tariff will be increased when the total electric units increased to a limit. Thus, in Kerala a fixed cost per unit is provided for different sets of units. The cost per unit is same between the minimum and maximum value of the particular set. And the cost per unit is increased in the next set and simultaneously the electricity bill also increased by moving from one set to next set. So, by small control in consumption of the electricity the electricity bills can be decreased without moving the total units into the higher sets. Other monitoring features include- water level monitoring and monitoring of cooking gas. Some homes have two or more water tanks. Out of that few of these tanks will be situated at the places where access is quite difficult. So, if an individual wishes to know the current water level at the water tanks it is possible through this monitoring system. Not only that it is seen that in most of the homes the water overflows and considerable amount of water is lost. Even using this system, we can prevent the overflow of water. The monitoring system provide considerable alerts to the user before the water starts to overflow.

Other monitoring feature is the gas level monitoring. The monitoring system accurately monitors the gas level using load cell. Even in this feature it notifies the user when the cooking gas is about to get over. These are the monitoring features available in this system.

Now we have also included a security system. It uses a camera to identify the inmates of the house. i.e. it uses the concept of facial recognition in order to do this task. It even alerts the user on detecting intruders. We are also trying to include the criminal database and alert the Police department on such passage of criminals through these cameras. It even alerts the inmates about the criminal threats.

II. METHODOLOGY

Our system consists of two parts :

- (1) monitoring system
- (2) security system

The monitoring system consists of three parts :

- (1) electricity monitoring

- (2) water level monitoring
- (3) amount of gas monitoring

According to the tariffs made by Kerala state Electricity Board tariff regulatory committee, in our homes the tariff for the electricity bills is different for different sets of electric units. So, the electricity bills will depend on which set of units your amount of unit's usage belongs to. So, the amount of electricity tariff will be changed by simple reduction of usage of electricity. For example: According to the slab system the cost per unit will change after 100 units, then if your total amount of usage of electricity in your home is 102 units then you have to pay a higher amount of cost to the KSEB. So, if you regulate this total units that is 102 to under 100, then there will be a large change in your electricity bill. This 2 units can be reduced by slightly controlling the usage of electricity. To reduce this usage, you have to check the amount of unit used by looking into the electric meter and you have to monitor the meter continuously. But no one can monitor the meter continuously to check the usage. So, for monitoring the usage of electricity and reducing the electricity bill our system can be used

For monitoring the electricity, our system consists of two sensors (1) voltage sensor (2) current sensor. The sensors are connected to a microcontroller named esp32(nodemcu). As we know to find the voltage, we have to connect the sensor in parallel with main electric lines, in same way the current sensor has to connect in series with main electric lines. After that the 2 sensors are connected to the nodemcu. All the other calculations and working are done inside the microcontroller. From the sensors we got the voltage and current value, from this data we can find the power($\text{power} = \text{voltage} * \text{current}$) and the energy unit(kwhr) can be calculated by multiplying the power value and the time value($\text{energy} = \text{power} * \text{time}$). In our system consists of timer which can calculate the simultaneous time required. It can be reseted also. Moreover, the electricity cost can be also found through the system. It displays the simultaneous cost of the electricity. The system will send warning signals through the alarms and through app when the usage reaches to maximum usage of energy in a set of slab system. It also warns when the usage reaches 50%. Thus, the people can take the necessary actions by controlling the consumption of electricity. All the simultaneous values of voltage, current, power, energy, units consumed and electricity tariff is displayed both in the android app and led screen. Moreover, using the machine learning technology, the amount of electricity can be used upto which time without changing the slab system can be found.



Figure 1: block diagram of energy monitoring system

For monitoring the water level, an ultrasonic sensor is placed above the water tank. The ultrasonic sensor sends the ultrasonic waves to the water and receive the signals. So according to the water level present in the water tank, the receiving signal's time will change. Thus, the water level can be found. The signals from the sensor are sent to the microcontroller. And the microcontroller displays the water level in the android app and led screen. Thus, consumer can find the water level by simply looking into app or screen without looking into the water tank and can switch on the motor pump according to the water level.

For monitoring the amount of gas, a load cell is used. A movable stand is made and the gas cylinder is placed above it. So, by using the stand the gas cylinder can be moved or replaced easily. Thus, the weight sensor is placed in the holding stand. The load cell consists of strain gauge, so the strain gauge will have different voltage signals with different weight, so by using voltage change in the strain gauge the weight of the gas cylinder is found. The weight of the cylinder will be changed according to the amount of gas inside the gas cylinder. The load cell is sent to the load cell amplifier. A load cell amplifier is used to amplify the value sent from the load cell. From the load cell amplifier, it is sent to the microcontroller. The microcontroller will send the value of amount of gas inside the gas cylinder to the android app and to the led screen. Thus, the consumer can know the amount of gas inside the gas cylinder easily and can book the next gas cylinder before the gas cylinder gets empty. Thus, the electricity, amount of gas inside the gas cylinder, water level inside the water tank can be monitored and can take necessary actions in a simple, efficient and cheap way

In the next part of the system consists of a security system which helps to improve today's security system and can tighten the security too. In today's security system, the CCTV's can only record and save visuals and recordings into a storage device like SD card. In some CCTVs the live streaming can also possibly using internet access. But these features cannot make a tight security system. The consumers cannot look into the live streaming of cctv always. And we

can find the visuals later by using the saved data. So, today's cctvs can only be used for finding witness of crimes or can find the persons behind the crime.

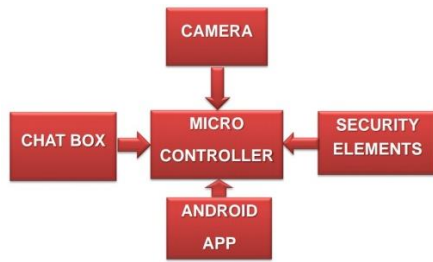


Figure 1: block diagram of security system

Therefore, it cannot be used to stop the crime or other problems. So, by using face recognition up to some extent we can increase the security. Here a database is created which consisted of images of persons. The images can be either the visuals of criminals or the visuals who are allowed to enter and can be taken as unsuspecting. The cctvs are just like our normal cameras and it is sent to our computer or to a processor having high performance. Then the Cctv camera will record the videos and these videos are converted to photos using programs, Then the photos are matched with images saved in the database. Thus, the images are checked whether it is matching or not. Thus, the people which is threaten to our security is identified and the system makes alarms and send messages to our phone through our mobile app. A chat box is added to the system which include a speaker and a mic. It is used to for chatting. By using this setup, the person having security app can chat with persons where the security system had installed just like video conferencing Thus, the security systems can be tightened through this system and can make our homes, offices etc.

III. SELECTION OF COMPONENTS

Components Required:

- NODEMCU
- CURRENT SENSOR
- ULTRASONIC SENSOR
- LCD MODULE
- CCTV
- SMPS
- LOADCELL
- LOADCELL AMPLIFIER.
- VOLTAGE SENSOR
- KEYPAD
- BUZZER

1.NODEMCU

Nodemcu is a microcontroller which consists of different analogue, digital pins and have many different useful pins. It also has an inbuilt-WIFI module. Using this module, the microcontroller is communicated with the android app. Thus, all the required data is transmitted and received between android app and microcontroller.

2. CURRENT SENSOR

The current sensor senses the current in amperes and measure the current value passing through the electric lines. The current sensor converts the high current passing through the electric lines to low current which can be used by the microcontroller for calculation. The current sensor is connected in series to the electric lines for measurement.

3.ULTRASONIC SENSOR

The ultrasonic sensor uses the ultrasonic signals to find the distance. It transmits the ultrasonic signals continuously in limited time intervals and receive the transmitted signals. Thus, using these values, the microcontroller calculates the distance from the sensor to the object. This is used for finding the water level in the water tank.

4. LCD MODULE

LCD is also called liquid crystal display. LCD is used for displaying all the information required for the consumer.

5. CCTV

Closed-circuit television is mainly used for video surveillance. The cctvs have night vision and high clarity cameras. Through cctvs microcontroller gets the required visual data for face recognition and is used in the security system.

6.SMPS

Switched mode power supply is used for converting the alternating current (AC) to direct current (DC). It also converts the high DC voltage to low DC voltage for the power use of microcontroller and other electronics equipment.

7. LOADCELL

Load cell is used for measuring the weight of the gas cylinder for finding the amount of gas present in the gas cylinder. It consists of a strain gauge which changes its resistance according to the load and thus it produces a

simultaneous voltage signal. By using this signal, we can calculate the weight of the gas cylinder

8. LOAD CELL AMPLIFIER

Load cell amplifier is used to amplify the signal send from the load cell before sending to the microcontroller. It is used because the microcontroller can detect voltage values between a certain limit. So, for limiting the values between these limit the load cell amplifier is used

9. VOLTAGE SENSOR

The voltage sensor senses the voltage and measure the voltage value passing through the electric lines. The voltage sensor converts the high voltage passing through the electric lines to low voltage which can be used by the microcontroller for calculation. The voltage sensor is connected in parallel to the electric lines for measurement.

10. KEYPAD

Keypad is used to send signals to microcontroller. It consists of buttons which may be numbers, alphabets or other special purpose keys. It is used to send signals to the microcontroller from consumers through wired communication.

11. BUZZER

Buzzer is used in the security system to alert the consumer when any security threats is used. Buzzer consists of some sound equipment which can catch the attention of the people and it is controlled and operated by the microcontroller.

IV. FUTURE WORK

Primary goals for future directions, the first work is to divide the monitoring of electrical energy into different sections such as kitchen, office room, bedrooms etc so that the consumption of the electricity can be find at different sections thus the increased consumption of electricity and can reduce the consumption of electricity easily and the tariffs of the electricity too. In the present scenario, the common people cannot find the fluctuations in electricity easily and the working of water pumps in these electric fluctuations can damage the electronic equipments including water pumps. So, finding these fluctuations and the electronic equipments (like water pumps) which require high energy is not allowed to operate in these abnormal conditions. The gas monitoring setup can be extended to the automatic booking of gas

cylinder to the gas providing authorities. The security systems can be extended to send the information about security threats to the police or other security authorities within seconds from the system with detailed evidence automatically.

V. CONCLUSION

This paper describes about how the electric energy in our homes can be monitored and how its tariffs can be reduced. The future usage and its tariffs are found and is displayed so that the consumer can take the necessary arrangements to reduce the consumption and its cost by using the concept machine learning. It describes about how the water level in the water tank and gas amount in the gas cylinder can be monitored. All the monitoring can be measured or sensed in a simple, low cost and efficient way. It also describes how today's security system using cctvs can be tightened using modern technology called artificial intelligence by face recognition and matching the face visuals with face images stored in the database. All the operation, control of the monitoring and security system have done through the android app and through the LCD module too. This system is cost effective with all the required features using the latest technologies and can be implemented without any difficulties.

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