SMART BUILDING USING IOT

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ABSTRACT: : *The "Smart building" concept is based on embedded system and IoT (Internet of Things) Technology. The presented model includes different features using which we can automate various tasks in our workplaces. The smart lighting system activate according to the natural light intensity available and human presence in the building. Smart Dustbins, which require less maintenance by opening when it detects human. Smart Watering systems help in the maintenance of lawns by measuring the soil moisture content. Earthquake detection module is use to warn about an earthquake and other seismic activities. The smart building concept is successfully designed using arduino and Thingspeak server is used for analyze the data.*

Key Words: *Ultrasonic sensor, LDR, ThingSpeak server, Arduino, IoT.*

I INTRODUCTION

With the evolving technology, peoples are looking forward to automating various tasks at their homes as well as in the workplace. So looking forward to easing work schedule, reduce manpower and at the same time reducing maintenance costs of various day to day facilities. The advancement in technology, further concentrate on sustainable development to ensure healthy environment as well. Arduino Uno is used as main part of the model; as all the events occur according to the actions specified within. The data collected from the units is used to plot graphs on a server which allows easy access of information to the user. Programming is done using Embedded C. The "Smart Building" is a model based on IOT technology. It follows the three-step methodology of IOT based systems [1]. It makes use of various sensors to acquire data from the environment. In the model which includes separate modules, the soil moisture sensor measures the moisture content and sends corresponding data to Arduino [2]. Based on the moisture content the Arduino sends data to the ThingSpeak server. From the readings obtained online, which can be notified about when to water plants according to the requirement. In the second section, an accelerometer that continuously records the orientation, calibrates the value to a fixed orientation. In case of the earthquake these values when change with a greater difference, the system will generate an alarm to notify all the people in the area about the disaster. The third section presents a smart dustbin, which has ultrasonic sensor to check for the human presence. As soon as a person comes in front of the dustbin the lid opens allowing the human to throw the garbage. The smart Lightning system uses LDR sensor to measure light intensity and switch on lights as per requirement. This will be accompanied by an ultrasonic module which will switch off lights in case of human absence. This entire data will be uploaded on ThingSpeak server, which helps to plot data and make corresponding data analysis, like frequency of garbage thrown, frequency of occurrence of earthquakes etc [3].

II RESULTS & DISCUSSION

This idea displays a model of a smart building, including features like smart dustbins, soil moisture measurement, earthquake detector and smart lightning system. Smart buildings have an environmental friendly design, working on cost-cutting at the same time. The initial cost of development might be higher by 8-10% than ordinary buildings, but they can cover up to 20-25% savings on energy consumption [4]. It is simple to use requiring less manpower. The data extracted can be viewed from anywhere in the world, thus, providing easy access to data. The entire system is connected to home Wi-Fi [5-6]. The system on regular intervals updates the data on Server. The user can anytime Login into his ThingSpeak account and receive the required data. A ThingSpeak channel is created. Data is received from Arduino IDE and plot the graphs according to the same. The values are saved accordingly once one can choose save channel option. Various other tabs are listed to make required changes in the channel. API keys tab is used to read and write data to and from the channel respectively. The import/export tab allows import/export channel data as per requirement. The graphs are plotted as shown in the following images.

2.1. Smart Lighting System

The main purpose of this part of the model is to prevent loss of current unnecessarily during daytime and make the system more efficient than before. In this, an LDR outside the building has been set up that will sense the light intensity outside and corresponding to same will adjust the intensity of LED inside the room. As an additional feature, there is a chance that during night a person might not be present in the room. So for the verification of same, an ultrasonic sensor has been used. This ultrasonic calibrates the initial orientation with the wall. If the person comes in its way, the distance measurement will decrease. This will send notification and as per the requirement, the lights will be switched on. So during daytime, the intensity of light will be lesser inside the room. During the night the lights will be adjusted as per the outside light intensity and human presence in the room. Fig.1 shows graph & Fig.2 depicts the flow chart for smart lighting system.

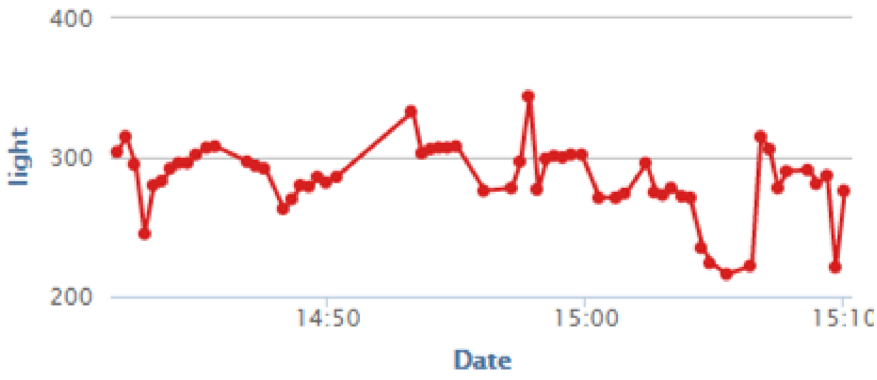

Fig.1. Graph plotted for Smart lightning system

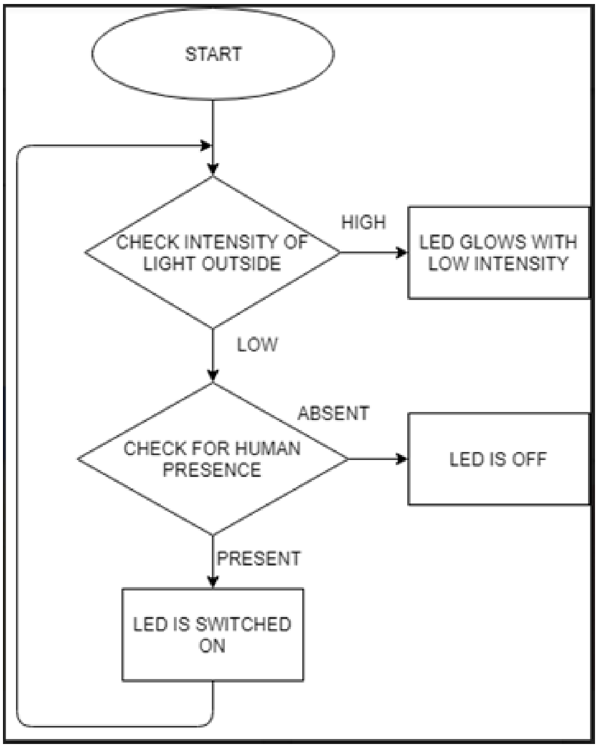

Fig.2. Flowchart for Smart lightning system

2.2. Earthquake Detection System

An earthquake is a natural disaster that is completely unpredictable. It causes huge damage to lives and property. It happens suddenly and no one can stop it but alert signal can be sent. Accelerometer ADXL335 module is highly sensitive to shakes and vibrations along the three axes. So this earthquake detection system detects earthquake vibrations and other seismic activities. This module, when installed in the building, calibrates the values of the three axes by taking the samples of surrounding vibrations whenever Arduino powers up. The recorded values are then subtracted from actual readings to get real readings. This calibration is done so that it does not send an alert with respect to normal surrounding vibrations like train travelling etc. The real readings are then compared with predefined maximum and minimum values by Arduino. If Arduino finds any changes in the values whether positive or negative, more then or less then the predefined values of any axis then Arduino triggers the buzzer. Sensitivity of the accelerometer is adjusted by changing the predefined vales in the system. Fig.3 shows graph & Fig.4 depicts the flow chart for earthquake detection system.

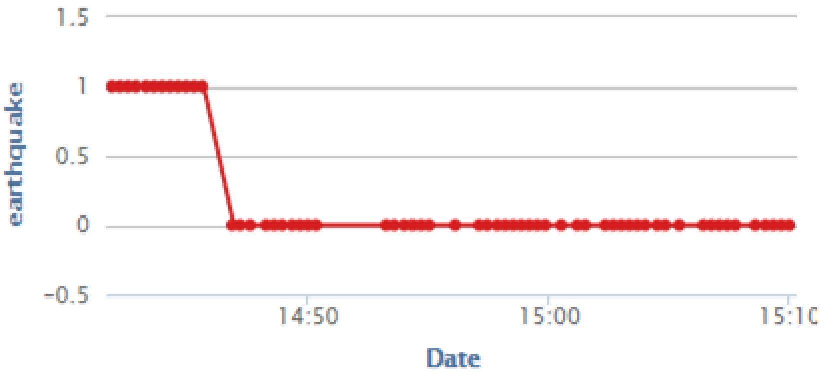

Fig.3. Graph plotted for Earthquake detection system

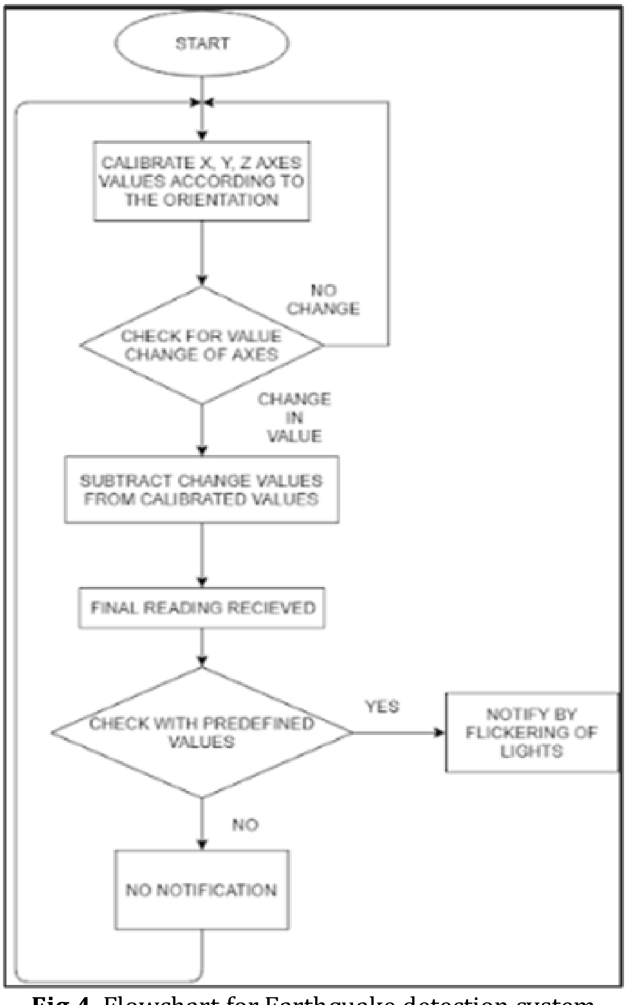

Fig.4. Flowchart for Earthquake detection system

2.3. Soil Moisture Measurement

In this soil moisture detector unit, soil moisture detector probe is used to sense the moisture in the soil and an Arduino to notify about when plant moisture level is going below the optimum moisture level. The sensor is embedded in the soil below a certain depth. The sensor measures the dielectric constant of all the soil, the constant readings are sent and when values go below an optimum level, it shows a notification to water the plants. Fig.5 shows graph & Fig.6 depicts the flow chart for soil moisture measurement.

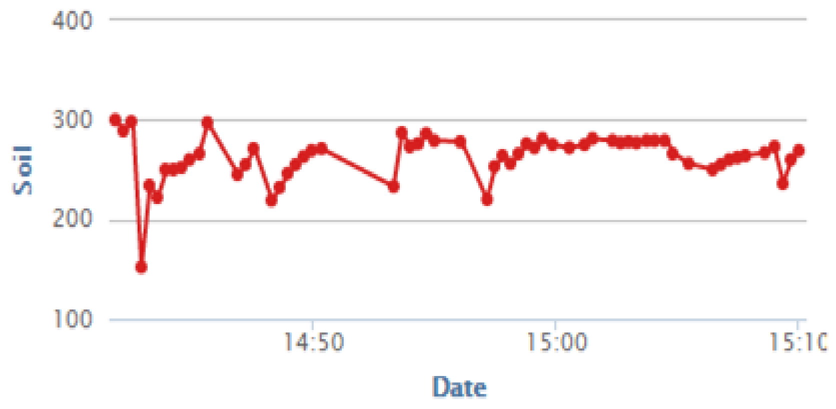

Fig.5. Graph plotted for Soil moisture measurement

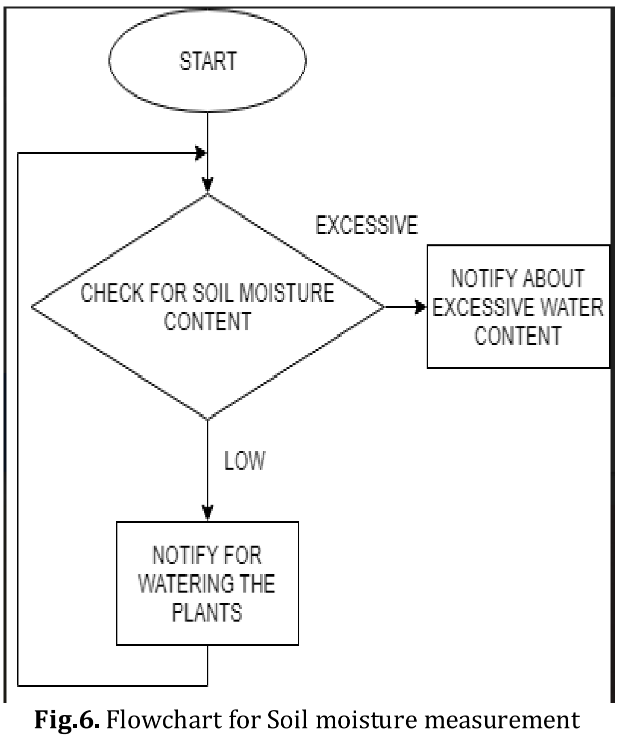

Fig.6. Flowchart for Soil moisture measurement

2.4. Smart Dustbins

The basic idea is to make normal dustbins smart using ultrasonic sensors. The dustbins are installed with ultrasonic on the front side. The dustbin calibrates the value of the distance of wall where it is kept. As soon as the person comes to throw the garbage, the value of the calculated distance is altered. Due to this change of values in distance, the notification is sent to Arduino. The Arduino on receiving signal sends a command to the servo. The lid is opened as per the movement of the servo. Now the person can throw garbage inside. The bin remains open for a period of three seconds and then closes automatically. This can prove animal-friendly if pets are trained how to use these dustbins.

Fig.7 depicts the flow chart for smart dustbin.

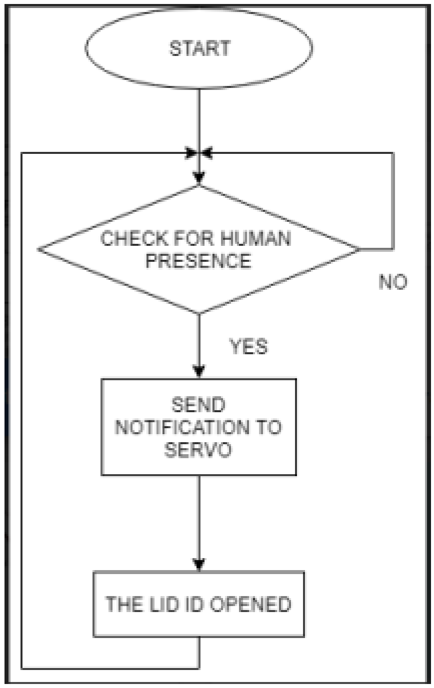

Fig.7. Flowchart for Smart dustbin

III CONCLUSION

In this paper, smart building concept has been explained and implemented successfully. Smart buildings are more secure than ordinary buildings. The smart building uses eco-friendly construction material with proper water management system provided. Smart buildings are yet not widely adopted and many changes and initiatives are required for use of these technologies to become widespread. Smart building initial setup cost is higher, but energy savings and cost-cutting on manpower overall sum up to 20 to 25%. Smart Buildings face a drawback higher complexity of the system, but this makes it simpler to operate by users and administrators. One can make smart building with RFID and biometric authentication. The human entering the building will be authenticated first using their fingerprints and also relative data will be sent on server showing in and out of people during the entire day. This will improve security level.

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