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Arduino and IOT based Home Automation

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KEYWORDS

Arduino, Internet of Things (IOT), electronic sensor, smart home, automation, Infrared (IR) Sensor, LDR sensor and PIR sensor.

ABSTRACT

Due to the recent advancement in wireless technology, automation is playing and important role in day to day life of human beings. In this sense Internet of Things (IOT) has promised the ability to provide the efficient data storage and exchange by connecting the physical devices via electronic sensor and internet. A "smart home" is a part of the IoT paradigm and aims to integrate home automation. A smart home will take advantage of its environment and allow seamless control whether the user is present or away. This paper presents Arduino and IOT based home automation. With a home that has this advantage, you can know that your home is performing at its best in energy performance. Real-time data collection and processing are made possible by the integration of these sensors with Arduino, enabling automated control and energy optimization in a home setting. This system works with an Arduino, a channel relay, Infrared (IR) Sensor, LDR sensor and PIR sensor are connected around a home. The IR sensors are placed in at entrance door of lock box of home. PIR sensor is used for any motion detection. Read the light intensity from the LDR sensor. Proposed system has the potential to enhance home automation and improve the quality of life for homeowners.

I. INTRODUCTION

The conventional houses are always evolving with the time for cater to change the requirements of people in terms of comfort and security. At present people desire's to perform the tasks effectively, simply and quickly with less efforts [1]. These requirements are satisfied easily while transforming the house as smart home by the implementation of home automation system. The home automation contains automatic control of temperature, lighting and other appliances, security and safety systems, gardening, housekeeping systems and home entertainment systems [2]. Such kind of systems can be developed for enhancing the security, comfort, convenience and energy efficiency by the integration of sensors which might monitor different parameters as well as actuators which may perform the pre-determined tasks.

The Internet of Things (IoT) is a system that allows devices to be connected and remotely monitored across the Internet. In the last years, the IoT concept has had a

strong evolution, being currently used in various domains such as smart homes, telemedicine, industrial environments, etc. [3]. Wireless sensor network technologies integrated into the IoT enable a global interconnection of smart devices with advanced functionalities. A wireless home automation network, composed of sensors and actuators that share resources and are interconnected to each other, is the key technology to making intelligent homes. A "smart home" is a part of the IoT paradigm and aims to integrate home automation.

In this digital era, each possible thing is desired to be automated that will reduce the efforts of human. At present the energy crisis might remain as a big challenge that has been facing and energy is need to be conserved [4]. Sensors are employed for accomplishing this. The sensor is a device that detects and measures nonelectrical metrics like weight, distance, speed, motion, humidity, temperature, etc., and it do this by the conversion of these physical metrics as signals that are electrically measured. The sensors have become an integral part and parcel of daily life from large scale industries to smaller households. Everybody can use these sensors.

We build and implement a home automation system using an Arduino Uno microcontroller, PIR (Passive Infrared) and LDR (Light Dependent Resistor) sensors in this research article. The main goal of this research is to develop an automated, intelligent system that can monitor and regulate various home appliances based on Fan, light, and motion changes [5]. These sensors and the integration of the Arduino Uno enable real-time data processing and acquisition, enabling effective and efficient home automation.

The Arduino microcontroller board will be utilized in this work that will facilitate with IR sensors. One IR sensor is installed on a door that constantly runs on the sensing mode and it detects the face of a person in front of door and it will send a message to personal mail of owner. The smart home system will be designed with unique personal assistant feature that may interact with a user and made their works through a personal assistant. This work is arranged as follows: The section II discusses the literature survey and section III demonstrates Arduino and IOT based home automation and section IV presented the implementation details of described model and finally paper concludes with Section V.

II. Literature Survey

In [6] represents IoT based smart home automation approach which is secure and also reduces computation overhead. Focus is sifted towards providing confidentiality, authenticity, and integrity of data sensed and exchanged by smart home objects. Computation overhead is also a concern for smart home solutions. Comfort and user requirements as per scenario or situation are basic need for automation. Automation with learning human behavior is also a major concern with smart home concept.

In [7] encompasses a system in which household interactions are made much easier through automation, safety and the Internet of Things helps to develop a system that allows anyone to remotely monitor and control certain parts of a house from anywhere remotely and also makes them safe with multi-cloud design to ensure greater safety. This system is significantly coupled with the low cost Integrated Circuits controlling the electrical components which eventually results in an efficient and power effective Smart Home Solution.

In [8] focuses on building a home security system which will be wireless. Security over a network is achieved using AES encryption. Security of house is managed by sending notifications to the user using Internet in case of any trespasser and it can also ring an alarm if required. Home automation is utilized by using appropriate sensors installed around house. Raspberry pi is used as a server and controller. Raspberry pi has task of controlling electrical appliances and providing authentication and security to user. In [9] gives a solution to having a precise and direct control and automatic detection of current state of devices with the use of micro-controller via an android application. It also gives a practical implementation of home automation using Wi-Fi in comparison to other technologies.

In [10] gives an overview of integrating the technologies of the Internet of Things into home automation systems, with a focus on the development and implementation of intelligent solutions that meet modern living requirements. Our study focuses on the benefits of IoT-driven automation, such as real-time monitoring, remote control, adaptive learning abilities,

and other factors that add to better user experience and energy management. This paper provides insights into design considerations and best practices for implementing a successful smart home automation system by performing an in-depth review of current technologies and case studies.

III. ARDUINO AND IOT BASED HOME AUTOMATION

The architecture of the Arduino and IOT based home automation is represented in below Figure 1. The different components like Arduino micro controller, Infrared Sensor, Door lock motor, LDR sensor and PIR sensors in Smart Home Systems are demonstrated and each block functionalities are explained in detail.

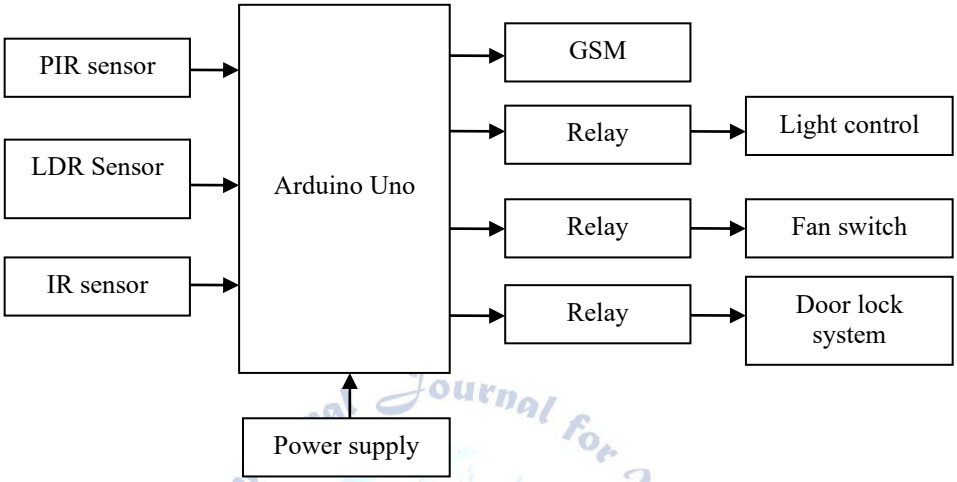

Figure 1. Architecture of the Arduino and IOT based Home Automation

The Microcontroller Arduino Mega board is responsible to control the devices which are connected with sensors and actuators. The microcontroller is a main head of system that may control and performs all operations of system. The Arduino Uno is a microcontroller board that works based on ATMega328. It contains an ICSP (In- Circuit Serial Programming) header, a 16 MHz ceramic resonator, 6 analog inputs, a USB (Universal Synchronous Bus) connection, 14 digital input/output pins, a power jack and reset button. The Arduino consists of everything that is required for supporting the microcontroller, by easily connecting it to the computer with a USB cable or power it with a AC-to-Dc adapter or battery for getting started.

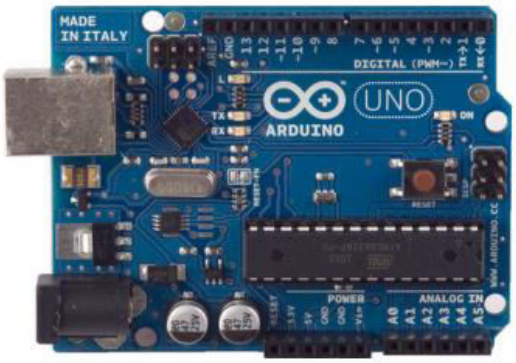

Figure 2: Arduino UNO Module

Use the PIR sensor to detect motion inside the building and control it. Create algorithms that recognize changes in sensor data and initiate the proper responses, such as turning on the lights when motion is detected and shutting them off when the area is empty. Make sure the system reacts instantly and takes into account changes in motion sensitivity and duration.

The IR sensor is a type of electronic component which is utilized for the detection of specific characteristics within its surroundings by emitting or detection of IR

radiation. The sensor which simply measures IR radiation instead of emitting is called PIR (Passive Infrared). Generally in the IR spectrum, the radiation of all the targets radiation and some kind of thermal radiation are not visible to the eyes but can be sensed through IR sensors.

Light Dependent Resistor (LDR) sensors are used in home automation systems to measure ambient light levels. These sensors offer useful information for automating lighting control based on the availability of natural light. Use LDR sensors to measure ambient light levels, then create a lighting control system that modifies the lighting environment in accordance with the strength of the detected light. By automatically adjusting the on/off status or brightness of lights, you may reduce your energy use.

The power supply is a circuit that provides the required DC voltage for running the other circuits. The voltage obtained from a main line is 230V AC (Alternating Current) but the circuit components need 5V DC (Direct Current). Therefore the step-down transformer is utilized for obtaining a 12V AC that is further transformed as 12 V DC by the rectifier.

The relay module may let the microcontroller as an Arduino for controlling the digital outputs which have high loads for instance DC or AC motors, solenoid, light-bulb, etc. This module is designed with 2 relays integration. Thus, it is capable for controlling these 2 relays. This relay module detail features are: 5V 2-channel relay interface board in which everyone requires 15-20 mA driver current; equipped with higher-current relay: DC 30V-10A and AC 250V-10A; a standard interface which is directly controlled through a microcontroller.

Working: Most of people across the world may prefer these devices for performing their day to day activities. LDR determine the appropriate lighting condition based on the light intensity. Activate or deactivate lights accordingly. Check the PIR sensor for any motion detection. If motion is detected Fan switch is ON. If a person is interacted with main door of smart home then IR sensor senses that there is a person in front of door and this message is sent to the personal mobile of owner through the e-mail that helps to notifying the owner as someone is at main door. If the stranger entered into the home and reaches the IR sensing area then automatically SMS is sent by the virtual assistant. If the owner gives commands to door lock motor to 'lock the door', then door will be locked.

IV. Result Analysis

A model house is built for the home automation system. At the door of the house a IR sensor is fixed to detect any movement near the door. If the stranger entered into the home and reaches the IR sensing area then automatically SMS is sent by the virtual assistant. If the owner gives commands to door lock motor to 'lock the door', then door will be locked. Light will turn on automatically when light sensor detects the darkness. A Fan will turn on when the any motion detection of humans by the sensor. Relay is used to switch the electrical appliances like light, fan etc.

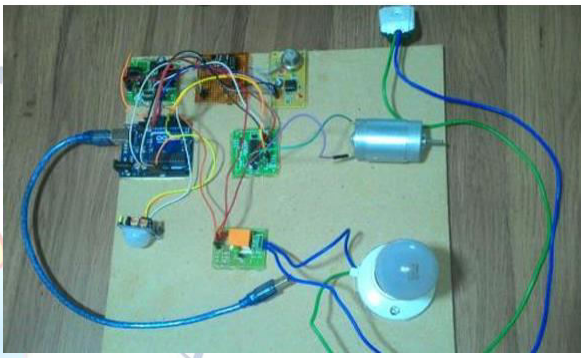

Figure 3. Hardware setup of described model

The overall pin configuration of Arduino and IOT based home automation is illustrated in below Figure 4.

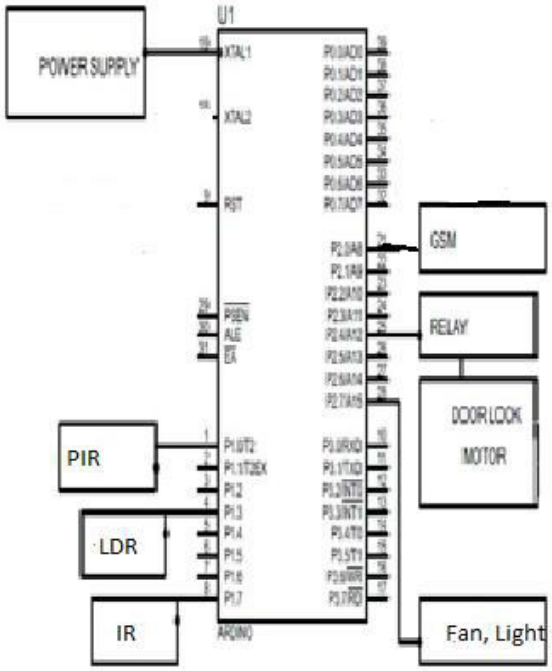

Figure 4. Pin diagram of described home automation system

V. CONCLUSION

In this paper, Arduino and IOT based home automation is designed and explained. Home automation systems have gained immense popularity in recent years due to the convenience and control they provide homeowners. Real-time data collection and processing are made possible by the integration of these sensors with Arduino, enabling automated control and energy optimization in a home setting. This system works with an Arduino, a channel relay, Infrared (IR) Sensor, LDR sensor and PIR sensor are connected around a home. The IR sensors are placed in at entrance door of lock box of home. PIR sensor is used for any motion detection. A Fan will turn on when the any motion detection of humans by the sensor. Read the light intensity from the LDR sensor. Light will turn on automatically when light sensor detects the darkness. Our study focuses on the benefits of IoT-driven automation, such as real-time monitoring and remote control.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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