

Automation System for Elderly People

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Abstract

The ratio of India's population ages 60 and older is expected to climb from eight per centum in 2010 to nineteen per centum in 2050, according to the United Nations Population Division (UN 2011). This project examines the idea of "smart home" in today's technologically advanced world and its contribution towards the betterment of older people's lives. Smart homes enable better task automation along with high security. The paper also puts emphasis on the 'challenges faced by elderly people' in the use of 'smart homes' incorporated systems.

Keywords - Arduino UNO, piezoelectric sensor, Bluetooth module, ultrasonic sensor

1. Introduction

Now-a-Days, governments, NGOs and even families are turning towards solutions which are technologically aligned for meeting the needs of elderly people. This technology can be used to occupy traditional roles like helping in walking, opening the door, automatic switching ON/OFF of lights etc. Automation system focuses to simplify certain tasks by making improvements in day to day life and making their life easier. The project includes an automated lighting system, centralized Bluetooth control for nearby electronic devices in a room and an obstacle detector stick. A piezoelectric sensor, ultrasonic sensor, Bluetooth module, sound sensor and PIR sensor have been used. Automated lighting system can be used for automatic switching on/off of lights. Obstacle detector Stick can be used for detecting any hindrance by blind people. PIR motion sensor can be used to detect any motion whereas sound sensor can be used to detect noise. So, this paper discusses the concept of smart home for improving the lives of elderly people and also focuses on the issues that they can face like accessibility.

2. Contents

2.1 Automated Lighting System

Automated lighting system uses a piezoelectric sensor for automatic switching ON/OFF of light. The circuit consists of piezoelectric sensor, Arduino Uno board, jumper wires, breadboard, LED/ Buzzer and resistors. A

piezoelectric sensor converts pressure into electrical charge. When some pressure is applied to a Polaroid crystal it results in deformation which in turn leads to the generation of electrical charge. The generated electric charge can be calculated using a pressure detecting sensor. It generates voltage proportional to the amount of stress, such as vibration or knock applied to piezoelectric crystal. Hence it is also called as a piezo knock sensor. When a person steps out of his/her bed, he/she will step on a strip of piezoelectric sensors. The sensors measure the change in pressure and convert it into electrical charge which results in switching ON of light. Similarly, when a person steps into his bed it will result in switching OFF of light.

2.2 Bluetooth Module

A centralized Bluetooth Module has been used for nearby electronic devices in a room. The circuit consists of Arduino Uno board, Bluetooth module – HC05, Android app, Relay system, Lamp/ Fan and Wires. We can control various electronic devices using Bluetooth module. The Bluetooth module is connected to the Arduino Uno board and an android app is used to control various electronic devices via Bluetooth.

2.3 Obstacle Detector Stick

An obstacle detector stick can be used to detect any hindrance by the blind people. The circuit consists of Ultrasonic sensor – HC SR04, Arduino Uno board, Jumper wires, Breadboard, LED/ Buzzer and resistors. The HC-SR04 Ultrasonic Module contains 4 pins. The pins include Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively. The trig and echo pins can be connected to any Digital I/O pin on the Arduino Board. If there is an object or obstacle on its path it will bounce back to the module. Considering the travel time and the speed of the sound, distance can be calculated. So in order to get the distance in cm, we have to use the following equation-
Distance = duration*0.034/2

2.4 PIR Sensor

PIR sensors basically detect motion. They have many advantages as they use low power, are easy to use, and

are small and not very costly. They are made up of pyroelectric sensor. They use 'infrared light' radiated from the objects. They work in a range of five metres to twelve metres.

We have combined PIR sensor with Sound sensor so that the LED will be ON only when both noise and motion have been detected. This makes it more reliable. Secondly, the PIR sensor has been combined with Bluetooth Module so that the person can control the lights (ie, the lights can stay ON/OFF) even after he/she enters the room using an android app via Bluetooth.

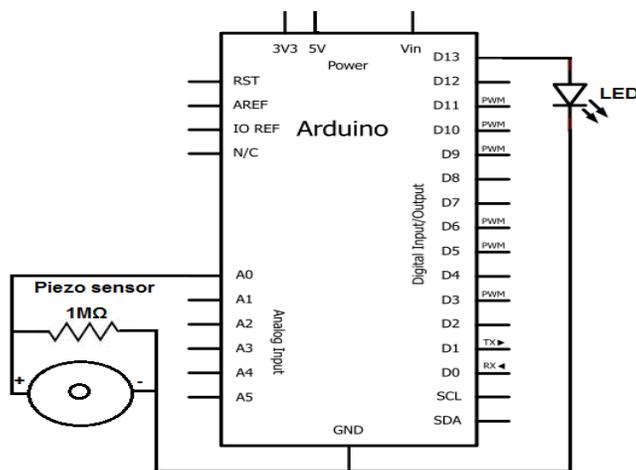
2.5 Sound Sensor

Sound sensor is basically employed for detecting any noise. For example, a microphone has small magnets in it which are covered by a coil. When the sound is detected, this results in vibrations. The magnets vibrate and this results in current produced in the coil. This is the basic working principle of sound sensor. It is connected to Arduino along with PIR so that the LED will be ON only when both noise and motion have been detected. The system will be more reliable than using sound sensor or PIR alone.

3 Figures

3.1 Automated Lighting System Circuit

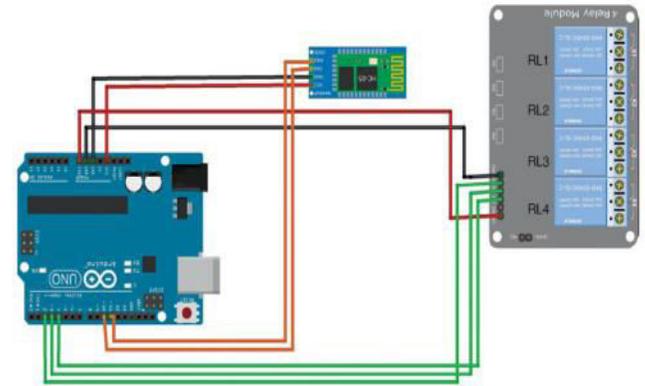
It consists of piezoelectric sensor, Arduino Uno board, Jumper wires, Breadboard, LED/ Buzzer and resistors.



Automated lightning system circuit

3.2 Bluetooth Module

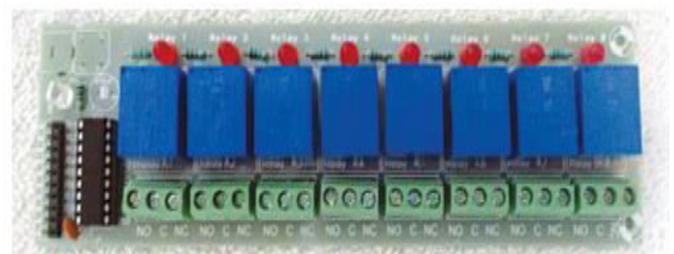
The Bluetooth module consists of Arduino Uno board, Bluetooth module – HC05, Android app, Relay system, Lamp/ Fan and Wires.



Circuit using bluetooth module



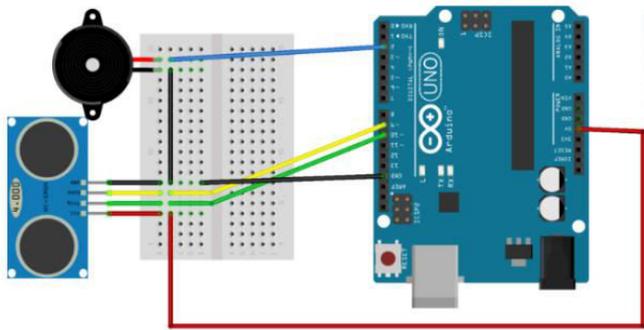
Bluetooth module



8 channel relay

3.3 Obstacle Detector Circuit

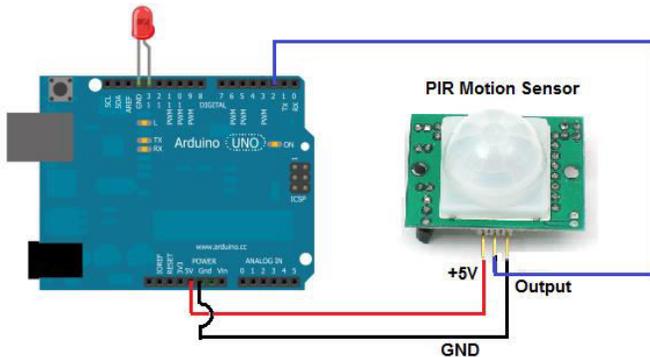
Obstacle detector circuit consists of Ultrasonic sensor – HC SR04, Arduino Uno board, jumper wires, Breadboard, LED/ Buzzer and resistors.



Obstacle detector circuit connections

3.4 PIR Sensor

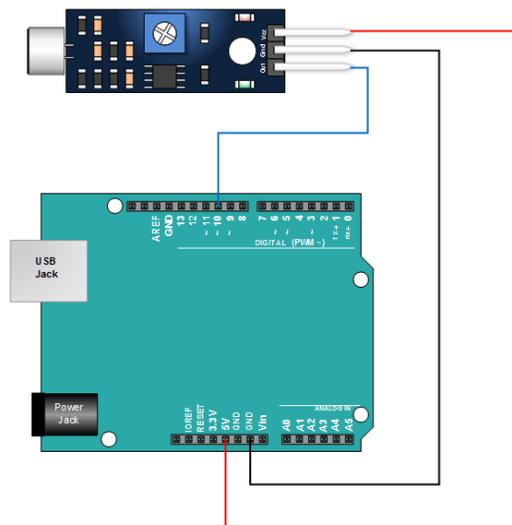
PIR motion sensor connected to Arduino using jumper wires.



PIR circuit connections

3.5 Sound Sensor

Sound sensor connected to Arduino using jumper wires



Sound sensor connections

4 Equations

The obstacle detecting circuit uses an ultrasonic sensor for calculating distance between the obstacle and the receiver. The equation used to calculate distance in cm is as follows-

$$\text{Distance} = \text{duration} * 0.034 / 2$$

5 Challenges

5.1 Economic Accessibility

A smart home incorporates certain distinct and new features which can prove to be expensive to old people. Maintaining smart homes can prove to be very expensive when it comes to buying, installment and maintaining smart devices. The government and stakeholders should collaborate and plan for executing smart homes for elderly people. For example, in Australia “the private sector has also developed special housing for older people as part of new developments”, so this reveals that the Australian government is putting efforts in this direction.

5.2 Technical Accessibility

Many older citizens face problems while using advanced technologies of smart homes. They can express less ease while using some devices. Particularly in rural areas, the information communication technology can play a vital role. All the end users should be involved in all stages of smart home development. It is important to assure that the technologies which are introduced are not unmanageable and unnecessary.

5.3 Subjective Accessibility

Elderly people face a large number of psychological barriers also. The older people are less used to the use of technology as compared to the younger slot. The technology service providers should take the time and effort to collaborate with older people to introduce such a change. The process of acquiring information and ongoing support are needed to occur in the context of real interactions.

6 Conclusion

Idea of smart homes can be applied for improving the lives of elderly people. The main aim of automation system for elderly people is to reduce the challenges faced by them like accessibility. The concept of automated lighting system and controlling various electronic devices in a room via Bluetooth module using an android app can bring a significant change in their lives. The obstacle detector stick can prove very useful

for the blind people. So, the concept of automation system can have a great impact on the life of elderly people.

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