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Advanced Ergonomic Chair for Modern Day Usage

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Abstract:

Smart homes play a major role in lives for maximum utilisation and for secure environment. This paper aims at developing a solution to the people who sit late nights for their work and fall asleep while working. By doing so they are wasting electricity, their precious night sleep and also are ending up with various spinal cord problem.This technology conserves energy by switching off the unnecessary appliances and also smartly turns on air conditionerconsidering the gender and the age of the person. The temperature of the air conditioner will be adjusted automatically based on the algorithm developed. All these facilities can be accessed via an application on mobile or a keypad attached to the chair. Hence this paper aims at building a complete smart room.

Keywords: home automation, arduino, bluetooth, membrane keypad, half bridge

I. INTRODUCTION

Home automation is vast and its applications are numerous. Home automation systems started developing from way 1990's wherein it was first used for security purposes [1]. The video and voice broadcasting and recording and storing was the first home automation system. Now it's being used for variety of applications. Home automation can be implemented in various ways by using different technologies available in the market [2]. Some of them are ZigBee based home automation, home automation using PLC, home automation using a universal remote and many other. It has become an integral part of Internet of things with a raspberry pi interfaced to the microcontroller. The main idea is to control the entire home by sitting on a chair. The keypad on chair has the capability of turning on/off the lights, fans, air conditioners and open/close the doors of the house. The optimisation of temperature of air conditioner is also a key parameter for the paper. There are various microcontrollers available in the present market as discussed above (for example like PIC microcontroller, AVR, ARM and Arduino). Based on available literature on microcontrollers, arduino microcontroller is found the latest, easier method to interface in the system. The user can change the code according to functional needs [4].

II. BACKGROUND MOTIVATION

Most of the people who sit late nights for their work competing with their busy lives usually fall asleep and they will be unable to turn off his lights and other running appliances.Elders also can't move from one place to another at ease for turning on/off the appliances.Kids generally can't reach the switch board which are usually too high for them to reach. Physically challenged people also needs the support from others during the time of emergency. In order to sort these problems there should be a unique and efficient solution.There is a need for a technology that can allow the people to access the appliances at ease.

III. DESIGN METHODOLOGY

Microcontroller forms the heart of the experiment. Arduino Uno is the microcontroller used here. Two arduino Unos are required for the experiment. A 4*3 membrane keypad and a 16*2 keypad are connected to the arduino. Membrane keypads are quite thin and can easily be mounted wherever they are needed. A bluetooth HC05 module is used for communicating between the two Arduinos. Two IR modules are used, one for communicating with the Air conditioner and the other for detecting the opening and closing of an eye. One L293D is used for running the dc motor which is responsible for the motion of the chair. At the receiver end one more arduino is used to which a 12v relay is connected. A step down circuit is used to convert the 220v to 12v and that is given to the relay as input. The devices are connected to the relay via this circuit. For the door motion two servo motors, one for the latch motion (M2) and the other (M1) for the motion of door opening and closing are used. Now a remote controller which is built on RF technology having a range of 250Mts and frequency 50Hz is used to open and close. The controlling part in the circuit was done with the help of controller and arduino was implemented and the code can be changed according to the user's requirement. To open or close the door, the transmitter from the remote controller sends a signal and the receiver at the door acts accordingly. In order to check the status of system IR sensor sends a signal to the receiver at the remote controller. A half bridge motor driver IC L293D, was used in the circuit to control the speed and direction of DC motors. A rack and pinion pair of gears was used to convert rotational motion of the servo motor into linear motion of latch.

Table 1: List of hardware components required

Hardware	Specification	Quantity
Arduino		2
Relay board	12v and 4 channel board	1
Servo motor	10rpm	2
RF transceiver	250Mts 45MHz	1
Rack and pinion		1
Half bridge	L293D	2
Circular gear		2
Liquid crystal display	16x2	1
IR modules		2
Bluetooth	HC05	2
Plastic sheets	5mm and 2mm	1 each
Hinges		2
DC motor	10rpm	1

IV. WORKING CONCEPT

The paper aims at developing a system that can be able to control the home by siting in the chair. A keypad and a 16*2 LCD are connected to the arduino. The user has 8 options on the keypad with which he can turn on/off the appliances in his room by simply pressing the button on the keypad. He can instead avail the same options by connecting the receiver end bluetooth module with his phone. A readily available free bluetooth controller applications are available in the android play store and windows store. This facility gives a slight advantage rather than relying on single communication mode.

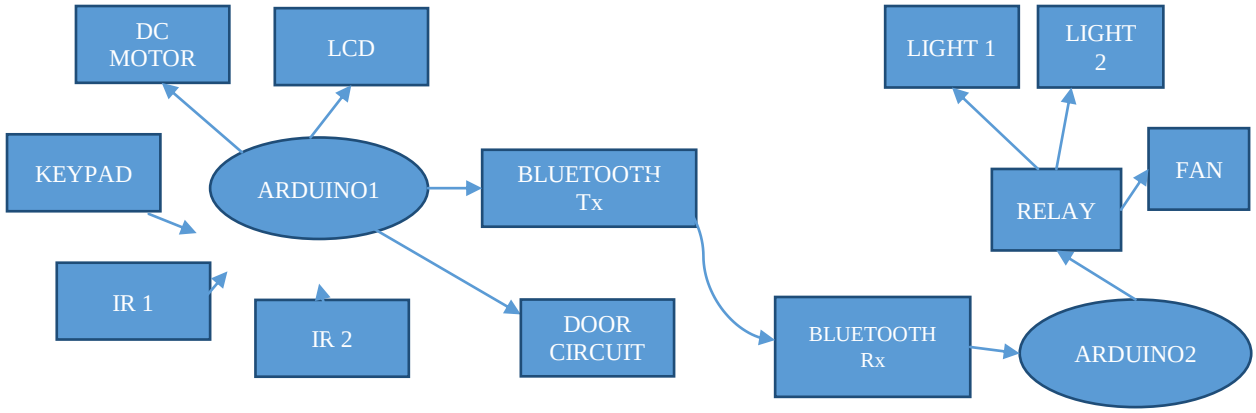

Fig 1: Basic block diagram

The microcontroller is connected to the two IR modules. IR1 is used to communicate with the air conditioner and IR2 is used to see whether the eyes of the human sitting in the chair is open or close. This IR2 is placed close to the eye by attaching it to a headband. If the eyes of the human are closed more than 5minutes then the lights off the room turn off and the temperature of the air conditioner sets to appropriate temperature depending on the person's age and gender. Most studies agree that a temperature between 20 and 27 degrees Fahrenheit is optimal for sleeping, with temperatures above 29 degrees and below 18 degrees doesn't help in providing a sound sleep. [4] Body temperature has also been linked to the amount of deep sleep an individual gets during the night, with cooler body temperatures leading to more deep sleep. [5] Sleeping in a hot environment results in dehydration and makes you tired. The addition of high humidity can intensify the effect of heat. [6] Deep sleep is important for feeling refreshed and recovered the following day. Table 2 shows some of the default temperatures set by the project when a user enters an automatic mode. Table 2 is tabulated from the study of [4] [5] [6].So when a person falls asleep the system sets the air conditioner to optimum temperature and reclines the chair to a position of 150 degrees. Here the chair is converting itself into bed and allows the peaceful sleep of the user. The person has also the option of converting this chair into a bed manually with the help of buttons on the keypad where the chair reclines a maximum up to 180 degrees. The turning on/off of the lights and fans is the primary function of the project. Key '8' is used for regulating the speed of the fan. This regulation is achieved by installing a triac circuit into the experiment at the receiver end. A step down circuit is installed at the receiver end to convert the 220v to 12v for the functioning of the relay where all these appliances are attached to. The door circuit has two RF transceivers out of which one is used to check the status of the door and the other for establishing a communication between the door and the remote controller. The frequency of RF waves here is 50 MHz and its range is 250 mts. An IR sensor is used to check the status of the door latch. An IR transceiver pair is used in which if the sent Infra-red rays is reflected back we

assume that the door is locked else we deduce that the door is open [3]. The motor used here has the torque about 10kgcm and rated speed is 10rpm. The paper uses two servo motors. The first one is used for closing and opening of the latch and the other servo motors are used to open and close the door. Both these servo motors are controlled with the help of Arduino as shown in Fig 2 (c). Rack and pinion is a pair of gears which converts the rotational motional into linear motion. The rotational motion of the servo motor is converted to the linear motion of the latch with the help of a rack and pinion as shown in Fig 2 (b). Three circular gears are used for the motion of rack and pinion as well as the rotation of the door.

Table 2: Temperatures for various age groups

	Male	Female
Age group	(Temp)	(Temp)
0-20	< 23	< 25
20-50	23	25
50+	25	27

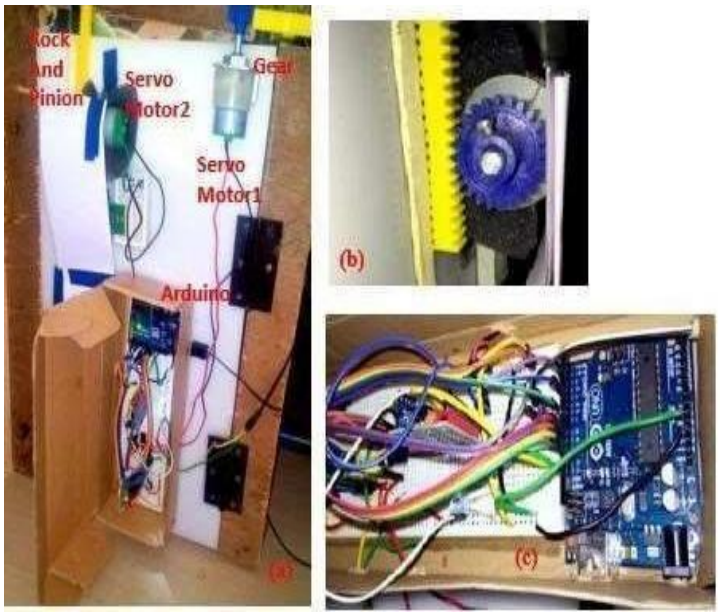

Fig 2: (a) Experimental circuit setup (b) Gear with rack and pinion at Motor 2 (c) Arduino connected to the circuit board DC electric motor which works by dividing a full rotation into number of equal steps.

V. LOGIC CHAINS AND FLOW CHARTS

The project interfaces a keypad with an arduino so that we can control the different appliances. The keypad we are using consist the digits from 0 to 9 and also contains # and *. As mentioned earlier in our project we are aiming the control of appliances such as ac, light, fan, inclination of chair, and position of the door. Here the key '1' is used for the controlling of ac. here we are providing an option for controlling of ac in manual mode or automatic mode. When the user press the key '1' the user have to press another key '*' for controlling the ac in manual mode and '#' for controlling the ac in automatic mode where the room temperature is adjusted to the predefined value. The keys '2' and '3' are used for controlling of two different lights,where the user can turn on/off the lights. The key '4' is used for turn on/off the fan. We are using the TRIAC circuit for controlling the speed of fan. speed of can be controlled with the key '7',every time the key '7' is pressed the speed of fan increases by 30 rpm and when it reaches the maximum rpm then its start decreasing by the same. The inclination of the chair can controlled with the keys '5' and ''6'. every time the user press the key '5' the inclination of the chair changes by -5 degrees up and similarly when the key '6' is pressed the inclination of chair changes by +5 degrees down. A separate RF remote control is fixed on the arms of the chair which is used for controlling the position of the door i.e. open/close [3]. Fig 4 uses a flow chart to explain the opening and closing mechanism of the door.

VI. CONCLUSION

The paper is successful in building a system with which the user can control the working of the lights, fans, air conditioner and door of his home just by sitting in a chair, in a much smarter way. The algorithm and code for the entire project is successfully implemented using an experimental setup. This project is very useful for people of all age groups form children to elders and also physically challenged people. Since it has two modes of communication either via bluetooth controller application or a keypad which is present on the arm of the chair it is very ergonomic.

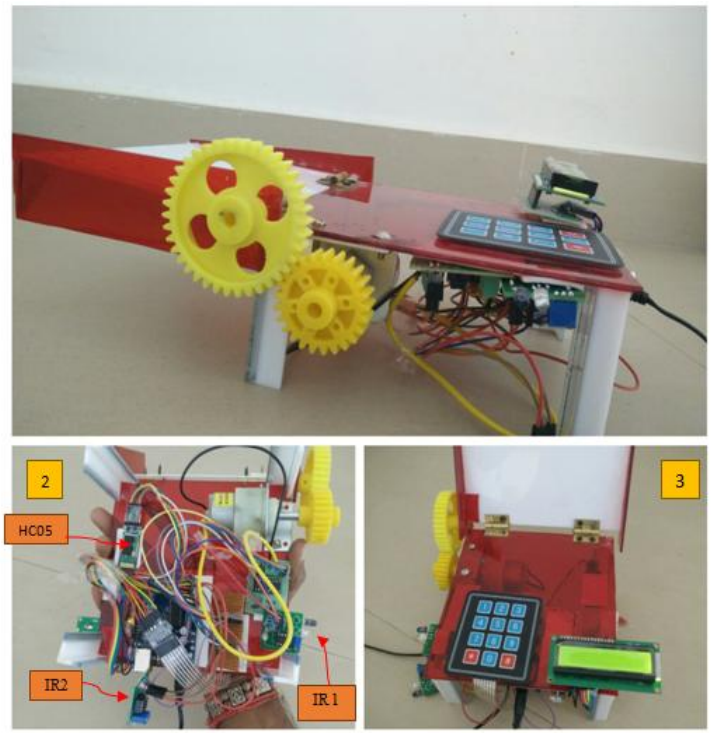

Fig 3: 1. Depicts the 180 degrees stretch of chair 2. It depicts the circuit components 3. Outlook of the experiment

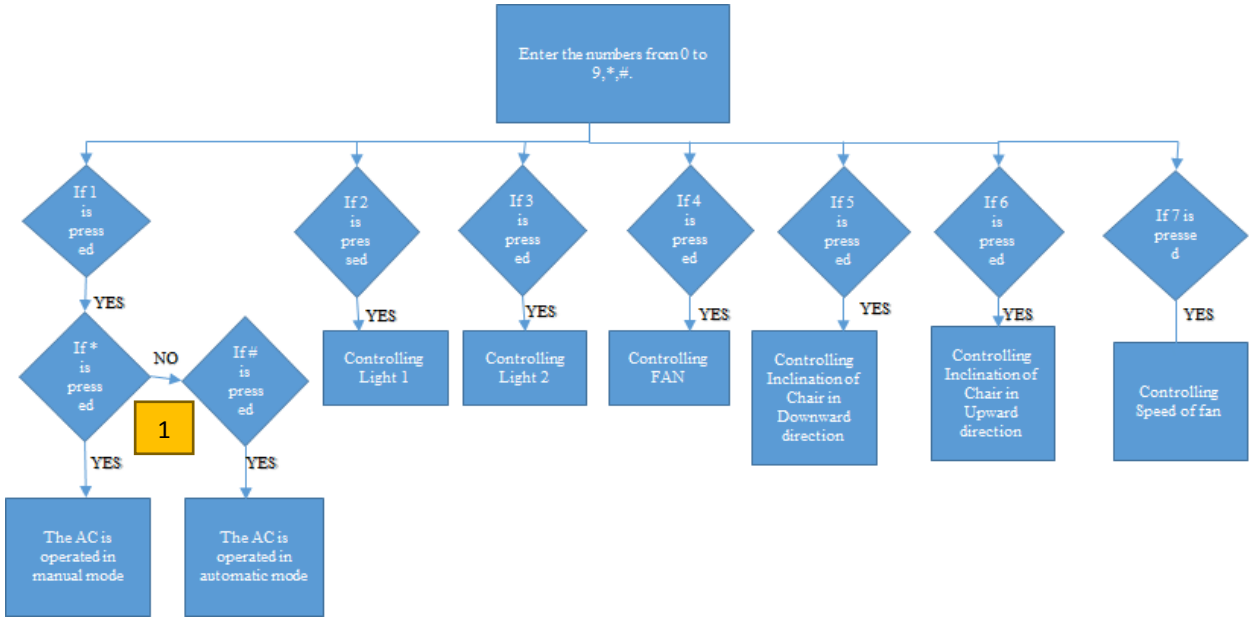

Fig 4: Flow chart of the keypad functions

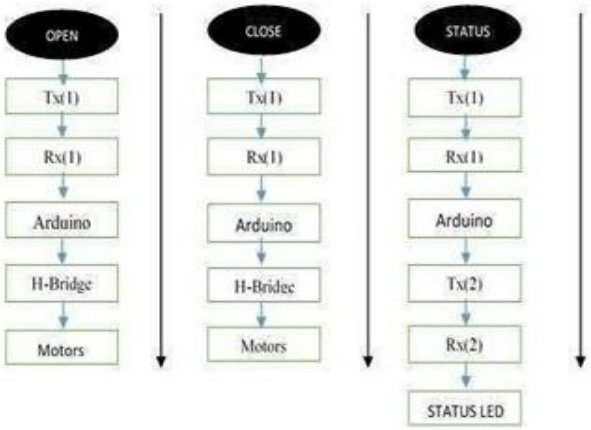

Fig 5: Logic Chain for Open/Close of Door

Here the following abbreviations in the logic levels are as follows

- Tx(1) = Transmitter at remote
- Rx(1) = Receiver at Door
- Tx(2) = Transmitter at door
- Rx(2) = Receiver at Remote

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REFERENCES

[1] Noriaki Morotomi, Yasumasa Endo, Yoshinori Emura, Nobuyoshi Asaka, *Home automation systems* Hideki Inoue US4959713 A

[2] Harish Iyer, Chetan Wagaj, Niketan Niwale*Arduino Based Home Automation System: A Survey* International Journal of computer applications Volume 115 No 8th april 2015.

[3] *M.R.Adarsh,*Sushmetha A., D. Shashidhar*Development of a General Algorithm– Open & Close Mechanism Based on Arduino Microcontroller and an Application of Algorithm on an Ordinary Door* International journal of Emerging Research in Management and Technology January ISSN: 2278-9359 volume-5, Issue -1 2016

[4] Onen SH, Onen F, Bailly D, Parquet P. Presse *Prevention and treatment of sleep disorders through regulation of sleeping habits* Med.1994; Mar 12; 23(10): 485-9.

[5] Jordan J, Montgomery I, Trinder J. *The effect of afternoon body heating on body temperature and slow wave sleep* Psychophysiology. 1990 Sep; 27(5): 560-6.

[6] Okamoto-Mizuno K, Mizuno K.. J Physiol Anthropol *Effects of thermal environment on sleep and circadian rhythm*. 2012 May 31; 31: 14.

