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SMART CURTAIN USING INTERNET OF THINGS

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Abstract— The paper focuses on the inabilities of physically challenged people those who are not able to get up from their bed to close or open the curtain or other appliances and they need some third person always to help them. We decided to make a system with the help of which they can close the curtain automatically without getting down from the bed or without the help of third person. The work uses the Internet of Things (IoT) technology, which is fast emerging. This technology is aimed at providing ease to control things connected by internet, for example, we can control the fans and lights in our house by being anywhere in the world. In the proposed model we are using a microcontroller interfaced to ESP8266 Wi-Fi module to make the internet connectivity successful. Blynk app is used to control the microcontroller.

Keywords: Blynk(app), Internet of things (IoT), Microcontroller (Arduino), Smart Curtain, , Wi-Fi module (ESP8266)

I. INTRODUCTION

Recent advancement in home automation has compelled many people to setup the same in their homes and offices. The use of this technology got many applications these days. This buoyant field is expected to provide an efficient and cost-effective way to help physically challenged people who cannot get up from their beds or chairs. These people always need a third person to help them with the physical work which increases their dependency on others. This paper proposes a system which concentrates on this situation. It proposes an automatic curtain system which uses a fast emerging technology called internet of things. The system allows the user to draw and withdraw the curtains using their smartphones. The advancements in cloud computing and data analytics allow different intelligent systems to process the data in a very efficient manner [3]. The automatic curtain systems available in markets use remote controls or wall mounted switches and are very costly. These days' people are decreasing the use of different devices to control other appliances or things instead they want to have a single device to operate everything. Lot of researches are going around the globe to decrease the number of remotes and to provide a single remote or something which is used by every single user in daily life like a Smartphone. The paper describes the overall system architecture of Smart Curtain from hardware to software implementation. Here we have proposed an implementation using Wi-Fi enabled system for managing the curtains without getting up from your position or without going near the curtains. Internet of things (IoT) is the development of the internet in which everyday objects have network connectivity allowing them to send and receive data. We can refer it to the internetworking of day to day devices and home appliances. It has evolved over recent years, a little work is done in applying IoT in several Embedded devices [2]. It allows the user to access different objects remotely across existing network infrastructure. The system consist of processing capability (microcontroller), have a Wi-Fi module (ESP8266), Relays, motor driver, power source (AC adapter), and other electronics (power distribution system and actuators). The system communicates wirelessly using the internet connection at home; microcontroller is connected to the internet via Wi-Fi module. The user needs to install an application in his smartphone to control the microcontroller. This new technology is exciting with its innumerable applications and never exhausting potential to provide support and advancements in different industries such as medical, defence, crisis management, agriculture, transportation, etc. The proposed system can help a lot to reduce manpower, to increase safety and to help physically challenged person to become independent. The installation of the system includes downloading an application on the smartphone, programming the microcontroller with Wi-Fi settings and app id, mechanical fittings. The major drawback includes the installation of mechanical fittings and actuators near the curtain. However to overcome these difficulties the

fittings can be done on the curtain rods and grills. The organisation of the paper is as follows. In section II we focus on the existing technologies. Section III gives the architecture of the system. Section IV gives the details**.** about the working of different hardware and circuitries. Section V briefs the performance of the system and other applications. Section VI concludes the system.

II. EXISTING TECHNOLOGIES

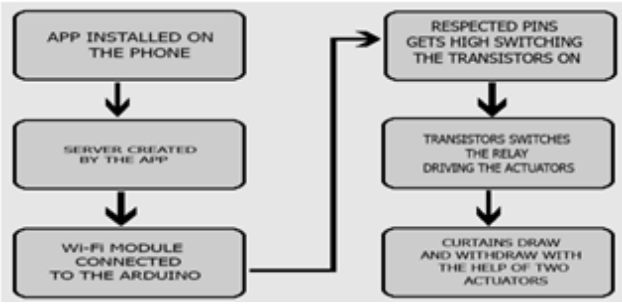
Here are some companies that manufacture automatic curtains or provide home automation devices but there are lot of limitations such as they cannot be customised as per the user needs. They are costly and needs an extra remote control or an external device to control them. Some of the companies and their products are listed below.

Somfy Systems

Company provides three different kind of curtain for residential purposes. The curtains are differentiated in designs and purpose of use. The controls provided are remote control, touch panels and switch boards. There are high powered motor and the starting voltage is 24V DC. The company manufactures the products on a very large scale and is available to sell their products in many countries.

Power Curtains

This is one of the major curtain manufacturers in the world. The company was setup in 2006. The company has been providing different curtains available in different sizes. All the curtains are remote controlled. Apart from these there are some more companies in market that supplies automatic curtains that comes with the same type of mechanisms.



III. ARCHITECTURE OF THE SYSTEM

Figure 1, shows the flow diagram of the system. The user needs to have a Smartphone which should have the BLYNK app installed on it. The user creates a project and according to the project it makes a unique ID. After the project is made the two widgets with push button switches are configured on phone. The program to be uploaded in the microcontroller includes the unique ID and the Wi-Fi settings, which are to be used to connect the microcontroller to the internet. The program executes according to the commands given by the user with the help of the smartphone. Using the phone user can control the respected GPIO pins of the microcontroller. As the respected GPIO (General Purpose Input Output) gets high, the transistor connected in the H-Bridge gets ON triggering the relays. The actuators connected to the relays rotate in clockwise or anticlockwise direction drawing or withdrawing the curtains.

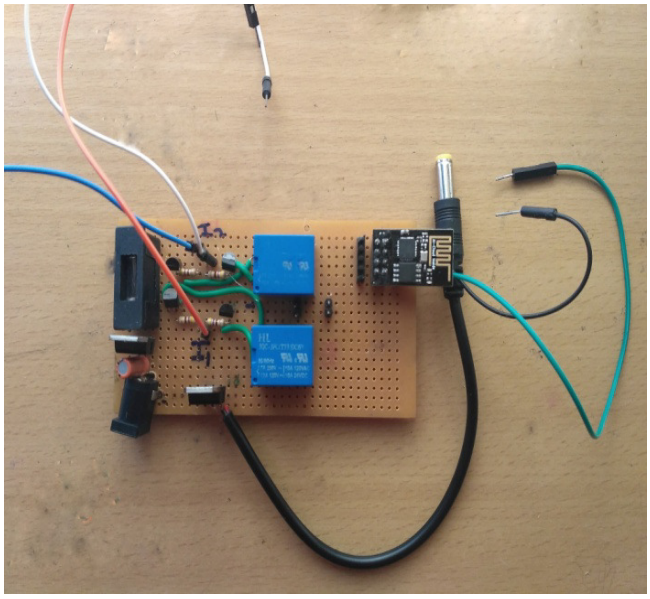
IV.DESIGN

The system contains two different hardware structures that is electronic circuit and the mechanical structure. The mechanical structure is a basic structure that is made by using things which are easily feasible or are usually available at homes. The electronic structure also uses basic electronics and the new technology that is Internet of Things. The Electronic circuit of the power distribution is shown in figure 2 and the microcontroller is interfaced in figure 3.

Electronic Circuit

The circuit is a basic electronics approach which can be termed as a power distribution board for the entire electronics. It uses some simple concepts like H bridge using transistors, switching relays, giving data using an Arduino, voltage regulators.

The circuit receives an input power of 12V at 1A, and it powers an Arduino Mega, four BC547 transistors, two 12V DC motors and an ESP8266 Wi-Fi module.There are two voltage regulators, LM7806 and LM7808. The regulated 6V output goes to the transistors and switches the relays which control the motion of the motors. The relays being used are 6V SPDT relay switches. And the regulated 8V output goes to the Arduino Mega 2560. Blocks of Power Distribution system are shown in



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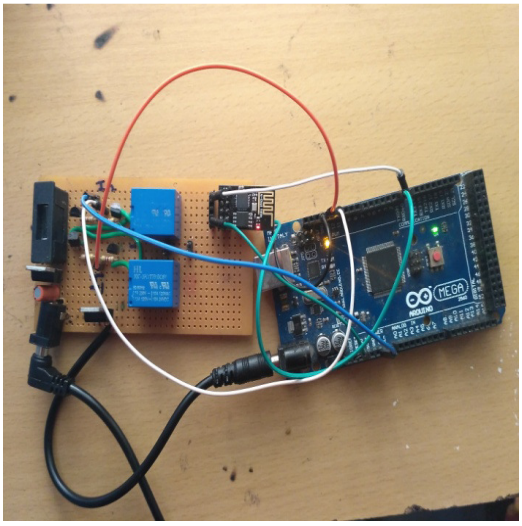

Figure 2: Power distribution board with H bridge

Voltage Regulators:

Voltage Regulators are small ICs which regulates the voltage to a fixed value from a higher value. These ICs are used in applications where a fixed value of voltage is required to keep the device running and different values of voltage are required to power other devices. Here 7806 and 7808 is used to power the transistors and Arduino respectively. 7806 is a positive voltage regulator

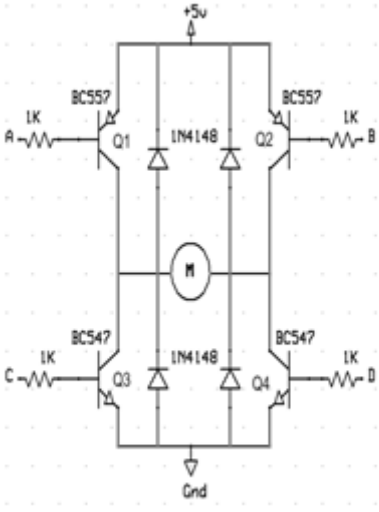

Fig1: Arduino

As shown in figure 6 is an open source microcontroller development board which consist of all the suitable components embedded on it which are required for the interfacing of the microcontroller. The Arduino that is being used in the proposed work is Arduino Mega 2560, which is a microcontroller board based on ATmega 2560, it has 54 digital I/O ports out of which 15 can be used for Pulse Width Modulation (PWM) outputs. It has 16 analog ports, 4 Hardware serial ports, ICSP ports, crystal oscillator, volage regulators, serial data converters and other necessary components. It can be programmed easily using the basic concepts of C programming language. The software which is used to program an Arduino board is again open source software issued by the development team of Arduino is called Arduino IDE. Some other types of boards are also available in the market such as UNO, YUN, nano, etc.

ESP8266*:*

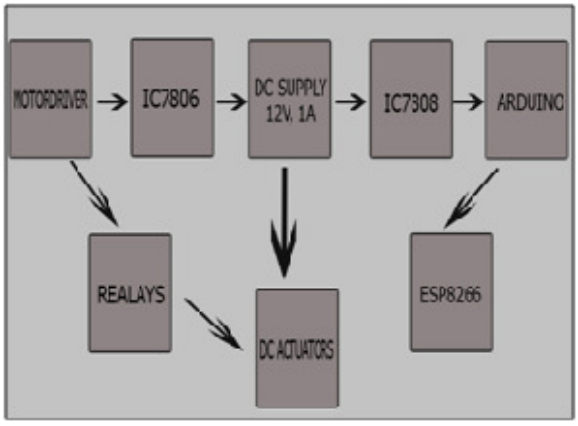

Figure 3: Microcontroller interfaced with

H Bridge[1]: H Bridge is an electronic circuit which is used to change the polarity of the output circuit. It is being used to change the directions of the actuators. It is shown in Figure.

Figure 4: Power distribution of the systeM

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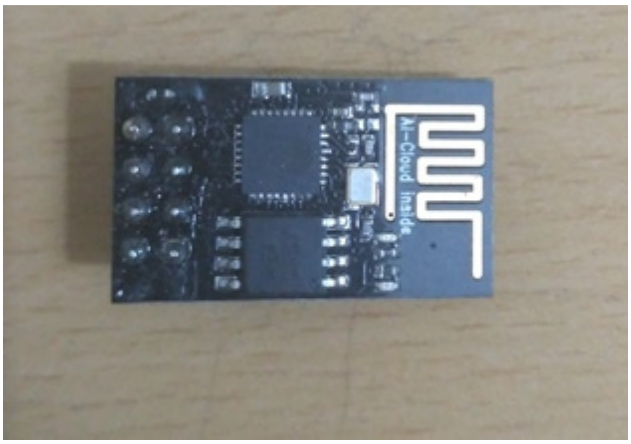

Figure 7: ESP8266

This Wi-Fi module is a self contained system on a chip which is integrated with TCP/IP protocol with the help of which any microcontroller can have the access to the wireless network. User can host a wireless network or can connect to a wireless network using this module. The module works on an operating voltage of 3.3V, has a flash memory of 1MB, has GPIO pins to directly interface any device and comes with a power consumption of less than 1mW when kept on standby mode. The module is programmed using AT commands which are pre installed in the memory of the module. ESP8266 Wi-Fi soc is shown in figure 7.

Mechanical Structure

Figure 8, shows the mechanical layout of the system. To draw and withdraw the curtains the string is attached to the right most ring of the curtain, when the curtain is closed and the motors rotate in order to pull the ring on either side. Both the motors will rotate in the same direction. Let us consider that the motor on the left be M1 and motor on the right be M2. When the curtain is closed the motors are rotated in anticlockwise direction and the string is rolled on the wheel attached to the motor M1 and the motor M2 will start unrolling the string, in this way the motor will pull the ring to the left and hence pulling the curtain to the left in order to withdraw it. To draw the curtain the motors are rotated in clockwise direction and the curtains are closed. The same ring is pulled in the right direction to close the curtains, motor M2 rolls the string and motor M1 unrolls the string. Pulleys are used at the ends to reduce the friction and to balance the forces. Pulley makes the movement of the string circular which makes the mechanism smoother.

BLYNK APP

BLYNK is an open source platform which provides the user to control different type of development boards using their smartphone with the help of internet. It creates a particular server for the user and gives cloud storage as well. It has its own libraries which makes it easier for the user to program the board. The app creates a particular server and then we can add the widgets (such as switches, joystick, LCD, etc.), the microcontroller is connected to the same server through a Wi-Fi module (ESP8266), and the command gets downloaded in the microcontroller and runs accordingly. Here we are using push button switches to the respective GPIO's of the microcontroller as high or low. The GPIO's drives the H-Bridge which drives the relay circuit and the actuators run to draw or withdraw the curtain. Figure 9, Figure 10, Figure 11 shows the different screenshots of the project that is created in the app. Button is a switch which is used to turn the pin13 of the microcontroller as HIGH which glows an LED. Draw and withdraw are the push button switches which when pressed, drives pin11 and pin12 of the microcontroller to drive the motor driver circuit. In figure 9 the curtain is in rest position. In figure 10 the curtain is drawn. In figure 11 the curtain is withdrawn.

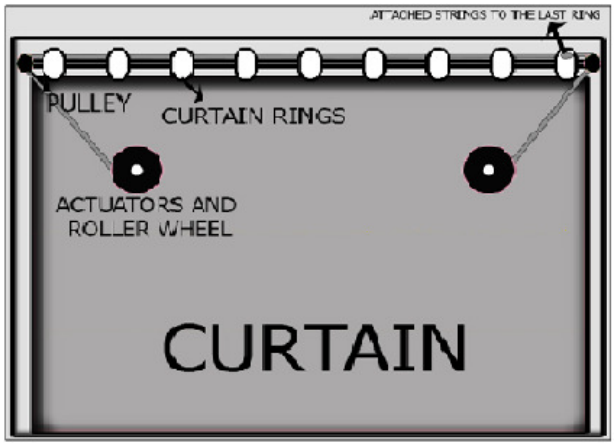

Figure 8: Mechanical Layout

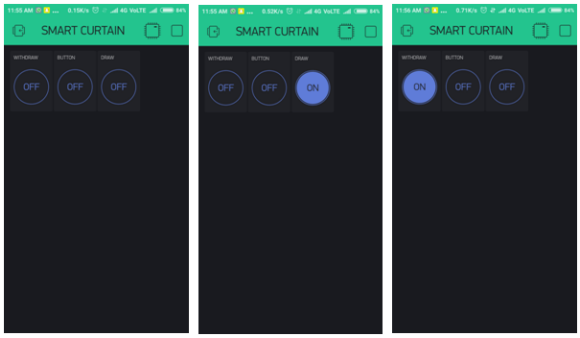

Figure 9

IV. COMPARISION WITH OTHER SYSTEMS

Proposed system is compared with some other systems available in the market in table 1.

Automatic Curtains	Customisation	Type of Control	Starting Cost (INR)
SomfySystems	NO	Remote and Wall Mounted Switches	18000
Power curtains	NO	Remote and Wall mounted switches	16000 for a length of 5ft.
FOX Domotics	NO	Remote, Wall mounted Switches, Smartphone	20000
Smart Curtain Using Internet of Things (Proposed Work)	YES	User's Smartphone	2000

Table 1: Comparison with other existing technologies

V. CONCLUSION

The paper introduces an automatic curtain system using IoT. The system has been implemented in real time and tested.

- User can easily draw and withdraw the curtain.
- Time taken for the communication is in the order of milliseconds, which is because of connectivity of internet.
- The system can be used for domestic and Industrial applications.
- The system can have more application such as switching AC appliances; hence the user can control other appliances as well.
- Minimal Power Consumption.

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