Smart Blinds

1st Aditya Randive
Department of Computer Engineering
Santa Clara University
Santa Clara, CA, USA
arandive@scu.edu

2nd Ronak Gune
Department of Computer Engineering
Santa Clara University
Santa Clara, CA, USA
rgune@scu.edu

3rd Radhika Chavan
Department of Computer Engineering
Santa Clara University
Santa Clara, CA, USA
rchavan@scu.edu

***Abstract*—The Internet of Things asserts that there exists a global need for all objects to connect easily. Today, smartphones, tablets, laptops and smartwatches makeup just a few of the interconnected devices by the greater population. As a result, a growing need for a wireless connection between personal devices like phones, and computers to everyday appliances exist. This idea extends directly to households, businesses and buildings, where a growing need for smart home or smart-business appliances has taken root. We take this idea to extend this smart capacity to window blinds by providing control to the user from anywhere through his remote devices. We also automated the closing and opening of the blinds depending on the intensity of sunlight. During the day, the blinds will open automatically so that the natural light enters home and during the night, the blinds will close to ensure the privacy.**

***Index Terms*—Smart, Internet of Things, IoT, ESP8266**

I. Introduction

According to the Accenture network analysis of 1,000 IoT technology platforms and platform complementors [8], the most heavily used IoT programs are the ones that make home life easier, more distinctive and more pleasant. Respondents also show a big preference for services that dont require them to go out of their way to make something work. People using the Internet of Things increasingly prefer interfaces that are more natural and less visible (and attention-sapping) than screens. In other words, they dont want to type instructions on a tablet, interact with a device, or mess with settings on a cell phone to get what they want. Instead, they value these technologies as living services that anticipate their wants and act on them. People like IoT services that automatically do what they would otherwise have to do manually. We wanted to take up this notion and automate the most common household task which is opening and closing of blinds.

The Smart Window Blinds project implements a Wi-Fi controlled and automated solution for automated control of household mini blinds. The project comes in two discrete parts: an attachable module and a hybrid app. The attachable module provides motorized control and/or automated control over generic mini blinds. Compared to what products are already available in the market, our project provides the same functionality and reliability but at much lesser cost. Moreover, the customers would not have to buy new blinds, but they can attach our module to their existing blinds. Our solution will work effectively for horizontal as well as vertical blinds where the blinds are controlled by a rotating rod. The following image shows how customers can integrate out the solution with their existing window blinds. Once installed, there would be no more need to use the tilt wand. The module will take control of the tilt wand and change its rotation depending on sunlight intensity or users control from his remote Wi-Fi device.

The module will either open or close the blinds fully. We have not yet implemented the functionality to partially open/close the blinds. The blinds can either be fully open or fully closed.

II. Research

We acquired the customer needs through market research of current window blind system. We came across a couple of products which provide similar functionality but for a much higher price. We decided to come up with a solution which will be flexible to use with current blinds and at much lower cost.

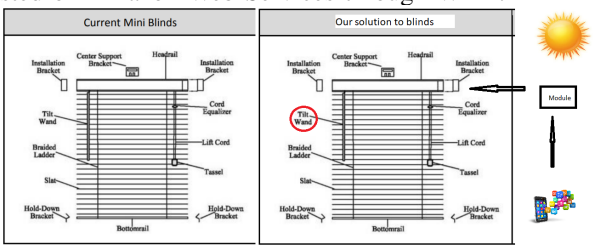
III. Approach

A. Our Solution

While deciding on the suitable solution our main objective was that the module should be:

1) Low Cost
2) Easy to use
3) Easy to install

The module is attached to the tilt wand attachment present on the smart blinds. The module then interacts with the server hosted on Amazon Web Services through Wi-Fi.



The Web Application and Mobile App enable the user to select two modes and the working of the module depends on these modes.

1) Automatic Mode:
   In this mode, the working of the module is fully automatic. The Light Dependent Resistor measures the amount of light coming in through the windows. This

light intensity decides if the blinds should remain open or close. This is based on a simple ideology: The window blinds should be opened when there is enough daylight available so that the energy consumption is reduced. The blinds then close as the sun goes down and the light intensity reduces.

2) Manual Mode:
In this mode, the user is free to control whether the blinds should be opened or closed. There are three options available to the user: Open Blinds, Close Blinds and Stop. When the user selects 'Open Blinds' the blinds start opening and start closing when the user selects the 'Close Blinds' option. These two operations are continuous and the user needs to press 'Stop' to stop the operation. We kept the working like this so that the user has the option to keep the blinds at whatever position he wants.

B. Hardware Setup

The module attached to the window blinds [4] consists of:

1) ESP8266 [5]
2) Breadboard [7]
3) Jumper Wires [7]
4) Continuous rotation Servo [1]
5) Light-Dependant Resistor [6]
6) Power supply

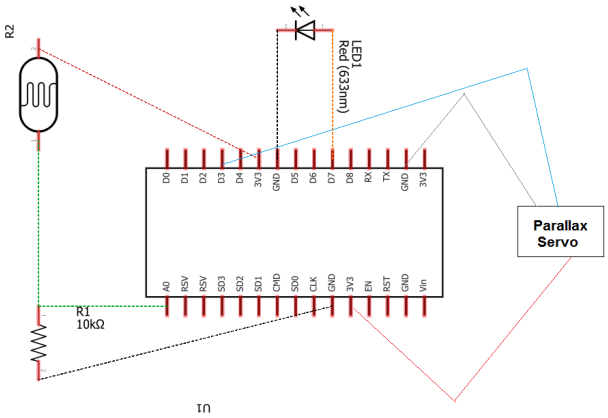


Fig. 1. Circuit Diagram

IV. Source Code

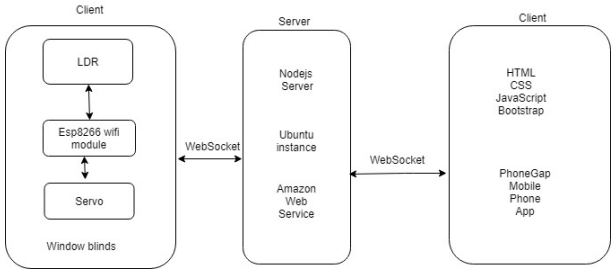


Fig. 2. System Outline

A. Arduino

In this particular operation, there are two main parts - Automatic operation and Manual Operation. By default, the operation is kept in the Automatic mode in which we control the servo according to the photocell value. If the user clicks on Manual mode, the code is designed to handle the "open","close" and "stop" operations. We use the "attach" and "detach" operations in the code at particular intervals so that the operation of the servo is controlled according to the position mandated and desired.

B. Web Application

To host the web application we created a web-page at ronakgune.com/smart .The web application is based on HTML, CSS, AJAX and PHP. When the user clicks the button on the web app subsequent POST request is sent to the PHP file stored in the server. This PHP file then stores the necessary information in a text file. For example, if the user presses the Open Blinds button then the PHP file stores 'open' in the text file. This text file is then read by the GET request sent by the ESP8266 code. The Web application shows the current status of the blinds by reading this text file and displaying the contents back on the web-page. We developed a hybrid mobile app using PhoneGap. This app uses the same code as the Web Application.

V. Challenges Faced

We faced few problems while implementing this project:

1) We had bought a coupler [2] as a connection between the Servo [3] on one end and the blinds on the other end. We had done our due diligence while procuring but still the radius of the coupler was bigger than the radius of the servo. We tried to use a workaround by using a makeshift plastic material to wrap around the Servo so that it fits the coupler. We were successful in rotating the coupler and hence the blinds. But, as it happens, we encountered a second problem explained below which removed the need for the makeshift plastic material.
2) The motor we had bought at first was not capable of full continuous rotations. It rotated only 180 degrees. There were some workarounds available online which dealt with disassembling the Servo and making some tweaks which lead to 360 degrees rotation. But this tweak was impractical since it confused the Servo and we had no control over the speed.
After realizing this we had to find the nearest store which sold Continuous rotation servos and had to rush there as they had just one last servo in stock. We finally got our hands on the Parallax Continuous Rotation Servo [1]
3) The light controlling switch we had was faulty.

VI. Conclusion

A. Findings

Working on this project made us realize the real potential of the ESP8266 module. It is indeed unbelievable that such a

module is available for less than 10$. The project taught us how to efficiently divide the tasks in between the team members. Given that the time-frame was quite small, individual team members working on different things made it easier to complete the project on time. We learned how to use AJAX and PHP to send POST and GET requests to store and fetch data. Although proper documentation was present, actually implementing it in the code proved to be a challenge at first because we were not familiar with the said technologies. But we learned while implementing the code and finally made it all work.

B. Future Work

1) Temperature and Humidity sensors could be added to this product. This can be used to control blinds according to the light sensors in tandem with the temperature sensors.
2) In our current application, we used a makeshift reinforcement to attach the Continuous Rotation Servo with the blinds. In future, we plan to use a 3D-printed object that connects the blinds with the Continuous Rotation Servo can be designed.

VII. Acknowledgment

We would like to thank Professor Amr Elkady, who enhanced our knowledge, inspired us and provided us the opportunity to learn and implement the concepts which made this project successful.

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