



An investigation into implementing rechargeable battery powered automated window blinds

By Sam Lamprey(2203378) - 2203378@student.uwtsd.ac.uk

Beng Electrical and electronic engineering

1. Introduction

One of the largest research areas in electronics is smart devices which make daily tasks more convenient. These devices are categorized into the internet of things (IOT) [1] “which refers to devices than can be connected together using wireless networks.” Renewable energy is also a growing area in electronics with solar panels becoming more commonly found in homes. This project aimed to implement both areas into a system by powering a set of automated window blinds using a battery charged by a solar panel. This was achieved by creating both a simulation and prototype to test the system. The system was controlled using a PIC microcontroller which would read values from sensors and then open or close the blinds accordingly.

2. Aims and objectives

Aim:

To investigate implementing a rechargeable battery powered window blinds system

Objectives:

Research existing systems

Research components

Outline system specifications

Build a circuit using a PIC microcontroller

Create a program for the circuit

Test the system to gather data

3. Literature review and background research

Research was carried out on 3 key areas, which were existing systems, existing research and research on components.

Existing products

[2] IKEA FYRTUR

- Works with rolling blinds
- Operated wirelessly using remote or app
- Battery powered using 2600mAh Braunit pack
- Uses signal repeater to connect

[3] Zignito smart wifi blind motor

- Works with existing blinds
- Works with cord gear and ball and chain gear blinds
- Input voltage of 12.6V supplied by mains
- Controlled using physical buttons, rf remote and app

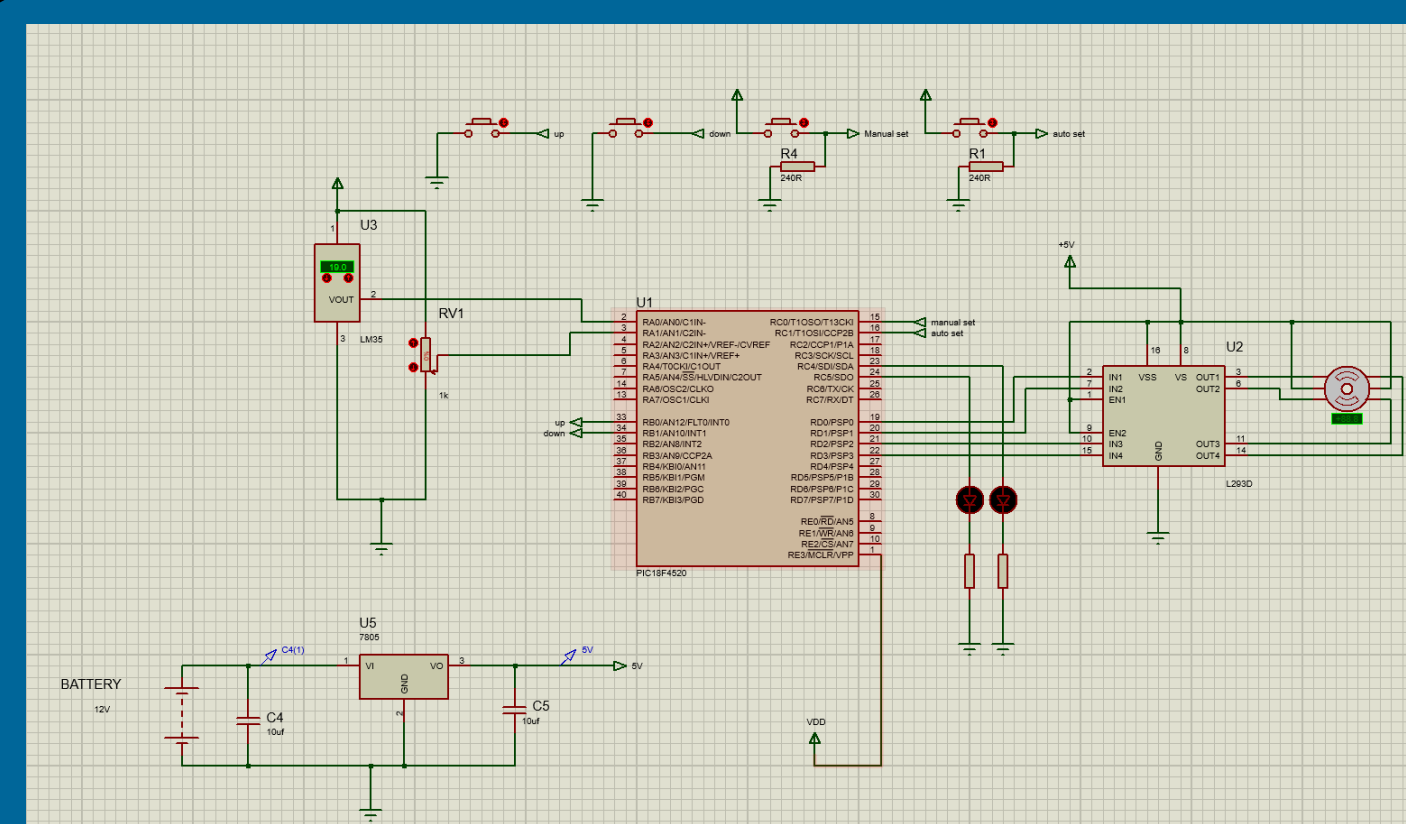
Existing studies

Multiple existing studies where looked at all of which looked at the impact that automated blinds can have on lighting and power savings. One study by [4] Mettanant and Chaiwi-watworakul found that automated blinds can save up to 24% on energy used for lighting while maintaining a suitable light level.” Another study conducted by [5] “Galasiu et al also found that automated blinds lead to more energy savings than static blinds.”

Component research

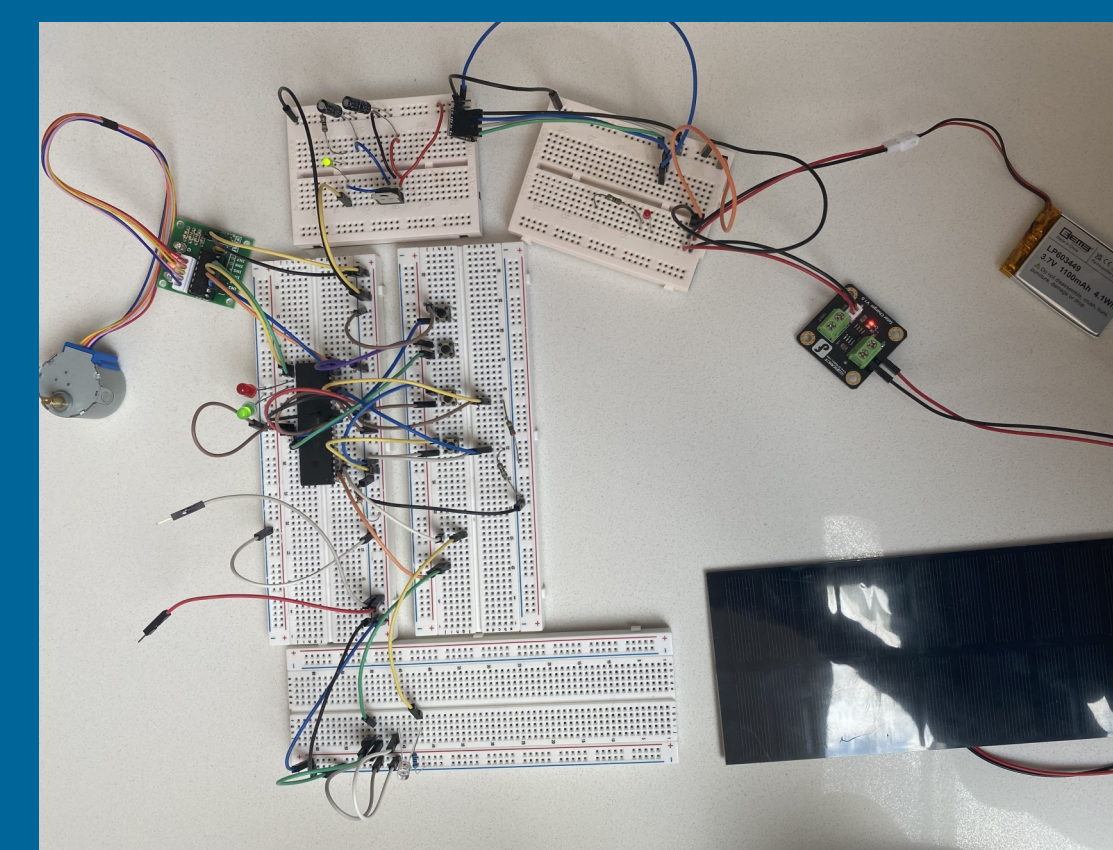
Research was carried out on components with the focus being motors and batteries. The research showed that steppers motors would be suitable for the system as they [6] “rotate in increments in a programmed manner.” Different battery types were looked at in particular lithium ion and lithium ion batteries. Battery charging circuits were also looked at as the battery used for the circuit needed to be charged by a solar panel.

4. Circuit design and implementation



The simulation of the circuit was created in proteus and the program was created using the CCS for PIC C compiler. The circuit used a PIC18F4520 to read values from an LM35 temperature sensor and a HW5p-1 ambient light sensor. The PIC would then output to the 28byj-48 stepper motor using a motor driver. The circuit also contained buttons to manual rotate the motor if necessary.

The prototype of the circuit was created on a breadboard with the battery circuit containing external modules. To charge the LIPO battery the solar panel would supply power to the charging board. The board also had an output which was connected to a boost converter which increased the voltage 12V from 3.7V which was then regulated to 5V using a 7805 voltage regulator.



5. Testing results

Testing was completed for both the simulation and physical prototype as well as the program for the PIC. The motor circuit was mainly tested in the simulation as it was easier to adjust the program if it wasn't working as intended. When testing the light and temperature sensors threshold values in the program had to be adjusted from the simulation as the light sensor wasn't available on proteus. The voltage regulator was also tested using various input voltages where it was concluded that an input of at least 7V input would be necessary to receive 5V due to a voltage drop across the 7805. The solar panel was also tested to ensure that it was outputting the expected voltage which was between 0 and 6.5V depending on the intensity of the light. The battery test also showed that the boost converter was suitable for increasing the voltage of the battery so that it could be used to power the system.

6. Conclusion

Overall the outcome of the project was as expected as the prototype was fully functional. Both the aims and objectives set at the start of the project were met which allowed the project to stay on track.

There could be some additional things that could be added to the project which would be to use a higher power motor so that it would work with a full set of blinds and an Rf remote to control the system.

7. Reference list

- [1] <https://shorturl.at/AjrZi>
- [2] <https://shorturl.at/SvaqL>
- [3] <https://zignito.com/product/smart-wifi-blind-motor/>
- [4] <https://doi.org/10.1016/j.egypro.2014.07.079>
- [5] <https://doi.org/10.1016/j.solener.2003.12.007>
- [6] <https://shorturl.at/aBcWm>