205 Automated Window Blind Opener with Light and Temperature Sensors

Problem/Need Addressed

Blinds play a large part in providing cover from the sun, in addition to providing privacy at night. However, a recent survey conducted by William O'Brien suggests that many users are inactive in operating manual window blinds. It has been surveyed that most office occupants do not operate their shades more than once weekly or monthly and they do so based on long-term solar radiation intensity and solar geometry trends rather than reacting to short-term events. This shows that window blinds are now mostly operated to improve visual conditions, such as sun glare or cloudiness. Instead of operating blinds to provide thermal comfort as well, air-conditioning and heating systems inside buildings replace the need to worry about operating blinds. Window and blind efficiency can save cooling and heating costs and improve comfort. Statistics also suggest that buildings account for 20-40% of total energy use in developed countries.

To address these issues, I have decided to design and construct a working model of an automated window blind opener. I have decided to add a temperature and light sensor so that the process will be fully automatic. Based on the measurements and readings of the two sensors every ten minutes, the stepper motor will be programmed to control the vertical movement of the blinds. My design will ensure that it will still incorporate their original purpose, but with maximum optimisation of a beneficial shade position. It will also ensure the minimisation of visual discomfort, as well as maximise efficient energy usage.

Limitation (s)

- **A 3 month time limit was originally set on this project, which began in March. However, I was allowed to make modifications after this time limit to improve my report.**

Alternate Solutions- Building Automation

Many developers have worked to reduce the massive amount of energy use by buildings. Building automation is the monitoring of a building's systems, such as security, lighting, heating, etc, and can work to keep climates in a building within a recommended range and light rooms according to occupancy. Thus, a building with such a system will have lower energy and maintenance bills. It creates a more reliable working environment and adopts more sustainable practices. This leads to a process of what is called 'smart buildings', where buildings can essentially understand regular patterns in energy use and then adjust to them, conserving energy when not needed.

Building automation systems use similar components to my project. These systems help save the building owners money, allow residents to be more productive and comfortable, and reduce the environmental impact of the building.

Risk Assessment

Equipment/Material	Risk	Precaution
Wires	• Electrocution • Burning	• Keep liquids away from the circuit and make sure working space is dry and well managed as to avoid knocking over anything. • Minimise the amount of metal on one's body. • Wear rubber shoes. • Ensure that the circuit is not live.
Pliers	• Can cause bruising or cuts to hands and fingers • Can be stabbed or poked into people around	• Wear appropriate PPE, i.e. gloves and glasses • Conduct cutting on a proper workbench, and always have a half a metre radius clear around you
Cordless Drill	• Hearing damage, • Hair and clothing getting caught • Eye irritation • Cuts	• Parental supervision • Tie hair back or cover with hair net to prevent hair getting caught • Do not wear loose clothing and secure loose items with an apron to prevent catches • Wear appropriate PPE • Have complete and firm control over drill pushing down onto surface keeping hands and fingers clear
Soldering Iron	• Heat burns	• Don’t touch the soldering iron element when in use • Parental supervision • Hold wires that are to be soldered with tweezers or clamps • Ensure that the cleaning sponge is damp during use • Always return the soldering iron to its stand when not in use. • Never put it down on the workbench.

Evaluation- Difficulties/Improvements

One of the major challenges was wiring. Without prior experience to these type of projects, I overlooked the amount of wiring that was necessary. I overcame this mishap through seeking help with other teachers, in Arduino forums, and websites like Sparkfun and Adafruit to aid me in the coding and setup. For the practical component of this project, I realised that I did not have appropriate equipment to construct one of the materials originally intended to be made. A lot of alteration and introduction of new materials such as the metal plate and brackets enabled me to successfully mount the blinds onto the wooden backing.

If this product was sold commercially, it would need some more development on the code so that it will be customisable for a specific blind type. I view it less of a home product, but instead a product for office spaces and large-scale buildings. Huge energy costs are normally generated with office spaces and large-scale buildings. It would in turn save more energy and work in accordance with the idea of building automation mentioned in the background information. Many businessmen or women do not have time to adjust their blinds throughout the day, merely operating them often only twice a day. My product would be extremely helpful, as well as benefitting their working conditions.

Improvements could be made on how the electrical components are stored, as it will need to be more compact and enclosed. As I made makeshift blinds, instead of using real ones, the product will need to be applied to fully operational blinds so that customers will be able to use it. It is also uncertain whether the current stepper motor will be able to hold the weight of larger, heavier blinds made from varied materials. Thus, a more powerful and larger stepper motor is needed.

Acknowledgements

I would like to acknowledge Ms Pan, my science teacher, for the constant support in the development of the project and to my parents, who assisted me with the practical components and accompanied me on frequent emergency and refund trips to Jaycar and Bunnings.