

Project Proposal Automatic shutters

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ABSTRACT

After recapitulating our project ideas from the first milestone, we decided to go with the Automatic shutters idea. The idea focuses on building an automatic shutter system and the implementation of an Android App to control our prototype. We think this idea could be very helpful for all kind of people, especially in the summer times.

Introduction

If you think about automatic shutters you may find yourself wondering about, as we did, why such systems are kind of rare these days even though realisation doesn't sound that complicated in contrast to the usefulness of such a system. One reason is the high cost of almost all commercial solutions in combination with a complicated installation process. Most commercial systems also focus on preventing every light from outside. We decided to follow a different idea.

Related Work

There is a system called "Rolling Shutters" made by somfy which offers a comparable functionality as we planned for our project. The Rolling shutters system offers different motor options called smart motor which can be controlled by the mylink App or different remote control options. The company claims that the system is also easily expandable and allows to control lots of shutter, creating scenes, synchronise it with other smart home devices or platforms. The system is also focused on heavy metallic shutters as you find them in almost every building in Europe. However this system seems to be really expensive because the prices of the motor are all about 300 Euros plus installation by a certified company. You also have to buy control elements(range from 74 to 500 Euros) and sensors separately. A brightness based control sensor like their "Sunis WireFree RTS" costs 204,20 Euro for example cheaper ones around 160 Euro. There is also a inside version of "Rolling Shutters" which can use different materials from textiles to light metal solution so here you need only a 150 Euro motor. So after all this system seems not to be an ideal solution especially if you are looking for a cheap and easy to build solution. Other related work are electric shutter systems offered by lots of companies so here you can find cheaper solutions however they do not have independent control options by external sensors

There is also a company called Paper chase <http://paperchaseboca.net/motorized-blinds> which offers a related solutions but this company only works in certain locations in the US and did not provide their prices online.

In terms of papers: There are many papers that talk about the gains and losses of having automatic shutter systems. In those Papers it is often said that people in offices prefer daylight over artificial light which rather irrelevant for our context due to the fact that we will have the possibility to manually control the system. Furthermore there are also some Papers that talk about how to save Energy using automatic shutters, yet none of those papers touch the concept of automatic shutters only their consequences or appliances.

Needed Requirements

For the realisation of our project we need an arduino micro-controller. An arduino uno will be sufficient. We will also need the following components:(prices and links are included in an extra document)

- DC Motor to pull the shutters up und down
- DC Motor Controller to control the motor with the arduino and to easily reverse polarity
- Bluetooth module for communication between the App and the shutter system
- extra battery to power the DC Motor because it will need more power then the arduino could provide
- Light sensor / photoresistor to measure the brightness at the window
- fitting cabels, breadboard and 2 buttons for early testing

Proposed approach

Our approach follows a different idea than the most commercial and homemade systems. Our shutter system will be an indoor rather than an outside installation and our shutters themselves will be made of a light weight textile material instead of metal. This keeps the cost at an exceptable level and allows us to offer a system that did not block every sunlight from the user like other solutions. So our system will reduce the incoming sunlight to an acceptable amount when the sun shines into the window instead of darken the room completely.

For the realisation we will use an Arduino board to control the shutters by a dc motor connected to a dc motor controller which offers a good amount of control over speed or polarity for example. We will also implement an Android App to offer the user more control over the system because the only hardware controls for the system will be two buttons to close and open the shutter. In addition it is not final whether this

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hardware controls stay in the final system or will be just used for internal testing because this functionality will be offered by the App too.

This manual controls work as following, if the user presses the up button the system will start to open the shutters if they are not already opened, until the shutters are completely opened or the user presses the up button again to stop the system from opening the shutters more. The same applies for the down button with closing instead of opening. This offers a simple and easy to understand way of controlling the shutters and the possibility to adjust them as the user wants as known from manual shutter systems.

The system will also have different independent action modes. The automatic called auto mode will close the shutters when a photoresistor or light dectormodule (allows better control than a photoresistor) placed at the window indicates that the incoming light is so high that it can potentially dazzle the user so the system will close the shutters completely. On the other hand when the indicated light level is low the system will open the shutters completely. The user can enable or disable the automatic mode in the APP between the manual control buttons as shown in the low fi prototype for the APP. Furthermore the APP will offer more customization options for the system. There will be the possibility to open or close the shutters in a user defined time interval as well as setting the system to automatic mode in an interval. In the schedules tab the user can create or edit new intervals and set the action mode in this time period. For example 12:00 to 14:00 with the close mode will keep the shutters closed from 12:00 to 14:00. The system will check the saved and enabled intervals if the current time matches with an interval and will then switch its state to this mode. If there are overlapping intervals the system will use the last valid one in the queue. In addition direct user controls from the APP (or the hardware buttons) will always override schedules.

Expected results

We plan to build a fully functional version of our idea but in a relatively small size. This makes it more portable than a construction as big as an average window while still maintaining the same functionality. Furthermore our focus is on creating and implementing the hardware and software of the electronic system more than the physical construction that it is bound to.

The app should work on Android phones and communicate with the Arduino via Bluetooth. With the app it should be possible to set the above mentioned intervals so that the user can close the connection to the Arduino at any time while the Arduino remembers the intervals by itself as long as it is not turned off. To support the Arduino with power and provide the exact time information, it has to be connected to a Computer or Notebook.

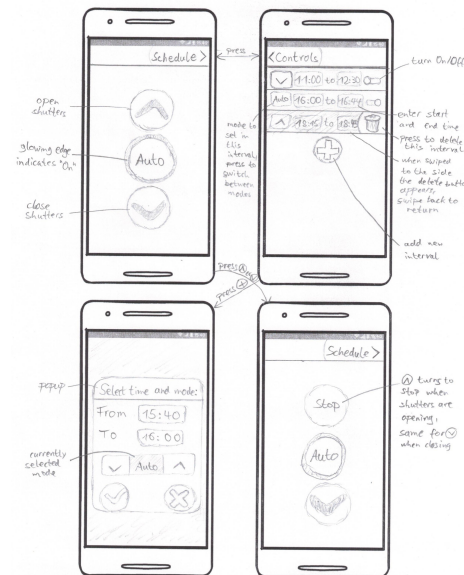


Figure 1. Low fi prototype of our App

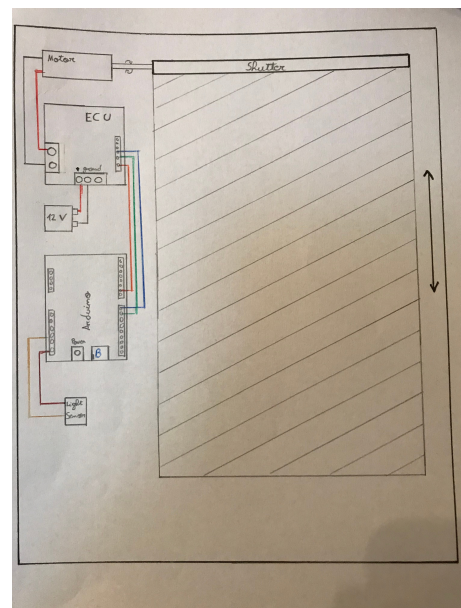


Figure 2. Low fi concept of the shutter system

Time plan

- Until June 6th: Physical construction built, Arduino connected to motor
- Until June 13th: Electrical circuits ready, shutters open and close via physical buttons
- Until June 20th: App itself works without communication to the Arduino
- Until June 27th: App fully implemented (with communication to Arduino), Project completed

- Until July 19th: Final Presentation prepared (Milestone 3)

Summary and conclusions

The system will be able to run in a fully autonomous way, with the possibility that a user can customize the experience to his/her needs. The App will be the interface that will allow these customizations. The entire system will be very easy to use. There are no complicated routines necessary, because everything will be controllable either via simple Button input from your Smartphone, or it will be fully automatic which makes it even easier for the user. The system is ideal to use in a living for watching television or in an office where you want to automatically control the shutters. We can conclude that the system will be very useful it has a lot of features that can not be obtained with manually controlled shutters, but we will lose nothing compared to manually controlled shutters, because our App will allow manual control over the shutters. The system will also be relatively cheap compared to other commercial Products, the highest cost will be getting the right Motor for a certain shutter.