Google Calendar for MagicMirror

Team 8

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Project Plan

Size Estimate

For the size estimate of this project, the team will be using function points. Though not an exact measure, function points estimate relatively how long each developer task will take. Based on the eight weeks time frame, a 13 point function point will take roughly a week worth of work to implement.

Setting up the Environment (1 point)

MagicMirror has made it rather easy to set up a development environment on Mac OS and Linux. This should be the quickest function to accomplish relative to the others.

Setting up the Raspberry Pi Environment (2 points)

Though setting up the Raspberry Pi environment should not be much more difficult than the first function, more time is allotted to this function than the first. This is mostly due to the nature of the hardware/software interaction, which will allow more room for unforeseen obstacles.

Sample Project using Google Sample Code (8 points)

This function should take a little less than a week to accomplish, it will require that all members know how to use Git/Github, as well as for all users to become familiar with the structure of MagicMirror.

Google Calendar User Story (45 points)

This is the core of the project and where the majority of the development time will be spent. Developers will be required to know JavaScript as well as know how to work with both node.js and Electron frameworks. Team members will develop a new calendar module for MagicMirror based on the existing one and solve the problems presented by the client. Overall this should be where the majority of work will take place and therefore it gets scores the highest on the function point scale. This user story will be split into further functions as follows:

- Deciding on format and Creating Specifications for Google Calendar config file (5 points)
- OAuth with Google Calendar (10 points)
- Downloading Google Calendars Initially (20 points)
- Syncing Google Calendars (10 points)

Merge iCal and Google Calendar User Story (40 points)

Though this function probably won't require as much development time as the previous function, it still scores equally on the function point scale. This is due to the nature of merging large amounts of code which can lead to many conflicts. Since no functionality is to be lost in this process, careful attention with testing must be given to this function, as well as allowing enough time to debug possible problems which are sure to arise. This user story will be split into further functions as follows:

- Ensuring Cohabitation of iCal and Google Calendar Config Files (10 points)
- Merging UI Modules (10 points)
- Merging Backend Modules (20 points)

Trying to Merge with the MagicMirror Source Code (13 points)

This last function will not be trivial due to the bureaucracy of merging with open source projects. This will likely take a few days of testing and back and forth communication with the developers responsible for the original MagicMirror project.

Risk List

Learning node.js

In all teams, there is often a discrepancy in skill in a particular area. For instance, members of the team who already have node.js experience will obviously be moving faster than those who do not. In order to mitigate this, early or challenging aspects of the code should be written while in a group setting. By working in a group setting, when an inexperienced member comes up against problems, they will have the guidance and support of a more experienced group member.

Difficulty Interfacing with Google Calendar API

As no member of the team has worked with the Google Calendar API, there is always the possibility that there will be complications. As with any technology, gaining proficiency in the usage of this API could be a long process. While this can never truly be mitigated, its impact on the development process can be minimized. By utilizing multiple guides and Google-provided startup exercises, the process of learning this API can be expedited.

Miscommunication in Requirements

Communication can be problematic in any group. When discussing a project with its customer, transparency of expectations is incredibly imperative. The group should use clarification when hearing requests from the customer as well as restating aspects which may seem obvious. This should serve to minimize the amount of misconceptions held by either party.

Misestimation of Time Requirements

No planning process is perfect, and there is likely to be more than one misestimation as to the amount of time or lines of code that a function will take to implement. Thus, misestimation is likely to negatively affect the development process. As a group, this has hopefully been minimized by always overestimating during the planning process. However, this is not a fool proof solution and is definitely incomplete. During the development process, misestimation can be further reduced by using clear communication when discussing current problems. As buffer time will be worked into the project estimation process, this risk is unlikely to need much more consideration.

Existent Changes in Upstream MagicMirror Repository

Whilst working on an open source program like MagicMirror, the base program is also constantly in a state of change. It is no stretch of the imagination that the MagicMirror code base will change drastically by the end date of this program. As such, maintaining flexibility in the code base of the project is important to ensure that the developed code will run with the version of MagicMirror upon the program's release. In order to do this, the team must be vigilant of change in the base program and constantly be testing against the current version of MagicMirror. This will alert the team quickly if some aspect of the MagicMirror code has changed in a way that no longer supports the developed program. This can be accomplished by merging upstream commits into the working branch of the project.

Code Breakage

When working with multiple people on a large project, there is always the possibility that code will be broken in an unrecoverable way. To help prevent this, the development team will utilize Git branching for each feature, and will ensure that reverting commits is possible if need be at all times.

High Level Schedule and Allocation of Resources

Week 1

Every team member is responsible for setting up the environment and getting MagicMirror running locally, then instantiate the current calendar module and understand how it works.. Members are also accountable for familiarizing themselves with the overall architecture of the MagicMirror project as well as the Node.js and Electron frameworks.

Weeks 2-4

During these three weeks, members will plan and develop the new google calendar module, at this point tasks will be split equally among each members and they will hold stand up meetings every other day to discuss the progress and possible hurdles. Members will work closely to make sure that the user story requirements are met and that the team stays on track as per the goals and time frame set in this document.

Weeks 5-7

Once creation of the new calendar module is complete the team will work closely together to debug the code, test the application and work on merging the new module with the currently existing one.

Week 8

The last step will be to merge the created fork of the MagicMirror open source project into the master branch. One week is being allocated for this step to allow for back and forth communication with the developers responsible for the project. A pull request will be created on the master branch. The team will work with the MagicMirror team to merge all the changes made into the main project page, where the client will be able to download the new product.

Requirements Specification

Introduction

The increasing presence of computers in day to day life has resulted in some analog devices becoming nearly archaic. Calendars, for instance, have widely been replaced or supplemented by programs such as Google Calendar and iCal Calendars. These technologies allow users to easily access their schedules and share them with coworkers, friends, and family

to coordinate their daily routine. With a new open-source project named MagicMirror, users can view their calendars, as well as news and weather information, right on their bedside or living room mirror.

This document details a software development project involving improvement of the foundation of MagicMirror's calendar module. Prerequisites of this process include setting up development and production environments for the project, including a build on a Raspberry Pi microcomputer. This will allow for the program to run on a dedicated device in order to mimic the traditional functionality and placement of an analog calendar. The Raspberry Pi also functions as a spatially efficient alternative to a desktop or similar device. This project's primary goal involves increasing the functionality of the MagicMirror program to more seamlessly interact with Google Calendars.

The scope of this project necessitates contributing to an open-source repository to develop new functionality for the MagicMirror. One core piece of the intended additions consists of allowing the MagicMirror to display shared Google Calendars, as it can currently only access ones owned by the current user. Additionally, the implementation of a notification system is desired to show the user their upcoming calendar events on the main dashboard of the MagicMirror. Moreover, this project aims to display Google Calendars and iCal Calendars alongside one another in one window. All project functionality will be designed as a drop-in module for the MagicMirror open-source repository, which currently exists on GitHub.

The purpose of this project is to access the information that MagicMirror typically displays, using a Raspberry Pi environment. The focus mainly centers on the calendar functionality; specifically, the majority of the project involves adding functionality to MagicMirror's interactions with Google Calendars. The scope includes both personal and shared Google Calendars. In short, the project should have the ability to notify the user about their upcoming events, and to merge Google Calendar and iCal Calendars into one display that the user can view. This project is made with the customer's wife in mind, such that she can plan her day around her business obligations displayed using her personal MagicMirror. As a side effect of contributing to an open-source software repository, the project has the indirect audience of any current user of MagicMirror who wishes to use or modify this functionality.

Project Overview

Currently, the MagicMirror product includes a calendar module. This module is able to display multiple calendars merged together. However, it can only display calendars that can be

downloaded in the iCal calendar format. Users who store their calendars in Google Calendar format must maintain ownership of their calendars and make them public; this is not always desirable. Additionally, MagicMirror must re-download the entire iCal file for each calendar every time it wants to update the displayed list of events, which by default occurs every five minutes.

The project described in this document will remove this constraint by leveraging the Google Calendar API to improve the MagicMirror system's usage of Google Calendars. It will also maintain UI/UX and feature parity with the old calendar module.

Customers, Stakeholders, and Intended Users

The specific customers for this project are Bill Danhauer and his wife. In general, all consumers of the MagicMirror product interested in the provided calendar integration features represent customers. The stakeholders for this product are the project implementers and the customer Bill Danhauer. The intended users of this system are people who use MagicMirror's calendar feature, specifically its existing Google Calendar integration.

Current System

MagicMirror is a full featured application that shows daily information in an aesthetically pleasing manner with the intention of displaying it on a mirror. A subsection of this application, the calendar integration feature, currently downloads calendars in the iCal format and displays them. This module is able to merge multiple calendars; however, in order to do so, it must have access to each iCal calendar file. Additionally it must re-download each one every time it wishes to update the list of events.

Proposed System

MagicMirror is an open-source project. Its plugins are primarily free and open-source as well. A module with the required Google Calendar integration does not currently exist within the MagicMirror project. Because such a solution does not currently exist, it can't be bought and has to be developed.

The primary feature of the proposed system is the ability to leverage the current calendar module and Google Calendar API to provide better features for users' Google Calendars. At present, Google Calendars are required to be owned and public for them to be displayed on the MagicMirror through the use of iCal files. The new product will make use of APIs specific to Google Calendar to allow users to avoid this restriction if they specify they are using a Google Calendar. It will also integrate seamlessly with the old iCal calendar module so that no existing functionality is lost.

Constraints

Precautions must be taken to ensure user's personal information is secure when given to the proposed system. The system should maintain a consistent UI and interface with the previous product. It should also maintain feature parity with the old module; no functionality should be lost, only added. The product must maintain compatibility with all versions of software MagicMirror depends on.

Development and Target Environments

As mentioned in prior sections of this document, the existing MagicMirror project is freely available online at a Git repository. The project is largely written in JavaScript; node.js is used for dependency management. Due to these factors, MagicMirror is largely portable and can be modified and improved using a wide range of systems, editing software, and environments.

Development Environments

Several different operating systems will be utilized for this project's development environments. The majority of work will be completed on Macintosh computers running macOS Sierra. However, a Bash environment using a Debian Linux distribution will also be configured; additionally, some work will be completed using a Bash environment on ChromeOS.

All development environments will have 'nvm' and 'node' installed. Several different text editors will likely be used for development; they include, but are not limited to Atom, Sublime Text 2, Visual Studio Code, Xcode, and Vim. Because the project is contained in a Git repository hosted on GitHub, 'git' will also be installed on all development machines. Additional programs may be used to provide a GUI for 'git', including GitHub Desktop and Tower for Git.

Target Environments

The target environments for MagicMirror are defined by the original project creators. The most commonly used environment consists of a Raspberry Pi 1, 2, or 3 running Raspbian (a variant of Debian Linux) with 'node' and 'electron' installed. However, it is important to note that certain features of MagicMirror do not function correctly on the Raspberry Pi 1, including display output using Electron. The MagicMirror project unofficially supports any operating system with a Bash environment with 'node' present. Examples of compatible systems include macOS, Linux, Unix, and Microsoft Windows 10 with the Linux Subsystem installed.

The project will be tested for target compatibility against a Raspberry Pi 3 running Raspbian. When verifying user interface elements of the project, a screen or window with a 1080p resolution will be used.

System Model

MagicMirror works on an open source, modular plugin system, and it utilizes Electron as an application wrapper. Because of the nature of this model, MagicMirror is able to take advantage of a growing list of installable modules contributed by the open-source community. Each module adds functionality to MagicMirror, like displaying emails, daily weather or news to the user. However, one downside of such a model is that there is room for redundancy; that is, the MagicMirror project has the potential to become plagued by repetitive modules which bisect features too much, leading to repetition of the implementation. In a worst case scenario, loss of certain functionalities across multiple modules can occur. With all this in mind, the work for Google Calendar improvement will be completed in a separate, new module; nonetheless, it will be integrated back into the currently existing calendar module upon completion. Ultimately, this will result in an improved module which will add functionality without any loss of existing features or redundant implementations.

Components

Currently, MagicMirror is split into several processes which rely on the node.js and Electron frameworks. One element, the core of the project, is written in JavaScript. It contains a module loader which possesses the ability to instantiate various modules specified by the user in a configuration file. Among these modules is the calendar module which will be branched, improved and ultimately merged back into the original module. On the other hand, the UI process, which is implemented with Electron, dictates how the modules are displayed to the user.

Two diagrams of the processes which make up MagicMirror are displayed in Appendix A and B. Appendix A illustrates the System Model for the initial, minimum configuration of the project, while Appendix B illustrates the System Model with both calendar modules combined into one.

User Interaction

Before describing the user experience when using this program, it is important to first identify the actors at play when running it. First and foremost, the user can be defined as the

person or persons utilizing MagicMirror and this project's module to view their calendar information. The second actor is the MagicMirror core module itself. Since the developers of the project outlined in this document are not responsible for the development of the base MagicMirror program, it should be considered an outside actor. The core MagicMirror program is responsible for displaying the dashboard information provided by this project's program as well as other information from other active MagicMirror modules.

The improved MagicMirror calendar module (with native Google Calendar support) is the last actor at play. The module is responsible for taking calendar queries from the user and providing that information to the MagicMirror to be displayed. In order to get a satisfactory understanding of the user experience when using this program with MagicMirror, each use case described below should be considered to highlight some facet of the intended functionality.

Use Case 1: Viewing an Owned Google Calendar with Persistence

The user boots up their Raspberry Pi, and opens the MagicMirror software. The MagicMirror core program then prompts the user for their login information for their Google account in order to access Google Calendars. The MagicMirror then passes that information off to the developed calendar module, which proceeds to download that account's Google Calendar events for all calendars specified in the configuration file. The Google Calendar information is then converted into the MagicMirror native format, and passed to the MagicMirror. The MagicMirror program displays this information to the user via the Raspberry Pi. The user then turns off their monitor, but leaves the Raspberry Pi on with MagicMirror running. A week later, the user turns on their monitor to see the MagicMirror still displaying the calendar information via the Raspberry Pi, without needing to enter their information once again. Any and all chances made to the calendar's events over the course of the week are displayed on the calendar without the need to download the calendar again.

A flow chart for Use Case 1 is available in Appendix C.

Use Case 2: Two Users View their iCal Calendars as well as their Google Calendars

Two users of the developed program wish to synchronize their events from multiple calendars, some (but not all) of which are Google Calendars. The two users boot up their Raspberry Pi and open the MagicMirror base program. The MagicMirror program then prompts

each user for their respective login information before passing that to the developed program. The developed program then downloads all Google Calendar and iCal calendar events from the associated accounts. The developed program translates all calendar data into one data structure before passing the data to the MagicMirror base program. Next, the MagicMirror displays any configured calendars to both users. As the two users add events on any of their calendars, the MagicMirror UI updates for each user in real time.

A flow chart for Use Case 2 is available in Appendix D.

Functional Requirements

The functionality of this program mainly consists of Google Calendar interaction. Thus, the majority of the requirements for this program focus on interacting with Google Calendar's API and handling authentication for the user. At each turn, there exists checking and handling of errors that might crop up when dealing with a network connection. Handling user authentication and gracefully failing when presented with possible configuration errors are also necessities. Finally, it is expected that the program has the ability to display calendar information to the UI.

The following table lists all functional requirements for this assignment, along with a verification step that can be performed to ensure the requirement has been met.

Functional Requirement	Verification
System loads calendar module configuration object if present in MagicMirror configuration file	A properly configured instance of MagicMirror is started with the Google Calendar module; “no calendars” error message is not displayed
System exits without error if calendar module configuration is not present (shows message on MagicMirror UI similar to existing "no calendars")	A properly configured instance of MagicMirror is started with Google Calendar Module; “no calendars” error message is displayed
System determines calendar type is iCal calendar if url field is present in calendar configuration	A valid calendar module configuration is loaded; if the loaded object has an “url” field the system processes it as an iCal file calendar
System determines calendar type is Google Calendar if OAuth field is present in calendar configuration	A valid calendar module configuration is loaded; if the loaded object has an “oauth” field the system processes it as a Google Calendar
For each Google Calendar configuration object:	

Functional Requirement	Verification
System loads client secret from configuration if client secret is valid secret with Google Calendar API	A valid Google Calendar configuration object is present; verify that system proceeds with client secret present in this configuration
System displays error if unable to access client secret from configuration object	An invalid Google Calendar configuration object is present; verify that error is displayed onscreen
System generates OAuth token from client secret if valid client secret	A valid client secret is extracted from Google Calendar configuration; verify that system generates an OAuth token given a valid client secret
System displays UI error if unable to generate OAuth token from configured client secret	An invalid client secret is extracted from Google Calendar configuration; verify that system displays/logs an error signifying it is unable to proceed with configured client secret
System downloads configured Google Calendar calendars	A valid OAuth token has been generated and configured calendar exists and is valid; verify system has stored the data downloaded from configured Google Calendar
System displays error if unable to download configured Google Calendar	A valid OAuth token has been generated and network error occurs; verify system displays an “unable to reach calendar” error message to user
System displays error if invalid data or error is returned from downloading Google Calendar data	A valid OAuth token has been generated and configured calendar is invalid; verify system displays an “invalid calendar” error message to user
System formats Google Calendar data into MagicMirror calendar data	A valid Google Calendar calendar has been downloaded, verify system has valid MagicMirror data generated from Google Calendar data
System merges all valid formatted MagicMirror calendar objects into one object	
System displays merged calendar object to configuration specified block in UI	Valid merged calendar data has been created; verify system displays merged calendar data to the user in configured UI slot
For each iCal configuration object:	

Functional Requirement	Verification
System downloads iCal file from configured URL	A valid iCal file URL is provided; verify system has stored data of iCal file downloaded from configured URL
If a network error is encountered, system displays error to UI	Verify system displays “unable to reach calendar” error to users
If an invalid iCal file exists at the specified URL, system displays error to UI	Verify system displays “invalid calendar” error message to the user
System parses and formats file data into MagicMirror calendar format	A valid iCal file is downloaded; verify system has MagicMirror data generated from iCal file
System merges all configured calendars (both Google and iCal) into one object for display	Multiple valid calendars are configured for module and successfully loaded; verify system creates singular calendar object containing all data from calendar instances
System displays merged calendar object on UI	Valid merged calendar data has been created; verify system displays merged calendar data to the user in configured UI slot
System re-downloads information from Google Calendar based on a user specified time interval	A valid Google Calendar has been downloaded and specified time interval has passed; verify system makes new request to Google Calendar API and feeds data into system
System displays error to UI if any errors occur while downloading	A valid Google Calendar has been downloaded, specified time interval has passed, and network error occurred; verify system displays “unable to update calendar” error message to the user
System displays new calendar information alongside unchanged information in UI	A valid Google Calendar has been re-downloaded; verify system displays new data in the configured slot on UI

Nonfunctional Requirements

Nonfunctional Requirement	Verification
System displays calendars on MagicMirror interface in a style synonymous with the original calendar module	A valid calendar configuration is loaded into module; verify system UI is not noticeably changed from original module UI
System must be compatible with existing users' configuration files	Using an originally valid user configuration, verify system handles configuration the same way the original module does

Nonfunctional Requirement	Verification
System accepts JSON configuration dictionaries with the same format as original calendar module	A valid calendar module configuration with original calendar configuration present; verify system designates config as iCal
Google Calendar configurations need to have a flag to let the new module know they should be handled differently; they do not need to be backwards compatible	N/A
Authentication tokens should preserve security of user login information	Using a valid configuration with Google Calendar configuration present, verify configuration contains no sensitive user information
Username and password must not be input in plain text format in any configuration file	Using a valid configuration with Google Calendar configuration present, verify configuration does not require a username or password to function
Response/download time for a Google Calendar should be less than or equal to response time for an iCal calendar (on average)	Using a valid configuration containing an iCal configuration and Google Calendar configuration, run several experiments to verify average loading times are similar
All code written should match the existing MagicMirror project in terms of portability	Using a valid instance of MagicMirror with the new calendar module installed, confirm it runs on all listed supported platforms
All node.js versions supported by MagicMirror currently should be supported by new code This requirement can be ignored if a version of node.js has been listed as insecure or support for it has been dropped by node.js maintainers (this supersedes MagicMirror support)	Using a valid instance of MagicMirror with the new calendar module installed, confirm it runs on all MagicMirror's supported versions of node.js

Feasibility

This project is feasible within the scope of a semester. The Google Calendar API is well defined and well tested; it can provide the data that this application's functionality requires. The MagicMirror calendar module's configuration standard is also well defined and is currently used in production environments. The created application must bridge these two tools and help them to integrate efficiently with the knowledge that desired calendar is a Google Calendar. This bridge will not be trivial, as the two domains know nothing about each other, and it will be

necessary to convert from one to the other while handling any errors that arise. The required functionality, detailed above, comprises approximately one and a half months of development time. This is a reasonable amount of work to be completed in a semester.

Minimum Requirements

The bare-bones version of this project should include the following functionality: The project interfaces with Google Calendar API, uses 2-factor authentication with OAuth to authorize users, is able to access shared and/or private user calendars, and refreshes the calendar's data at a user configurable interval. Interfacing with Google Calendars API should be trivial. Google provides extensive documentation and sample code to accomplish this task. Once authenticated, it is possible to access the required data with a simple network request.

OAuth authentication will likely prove more complicated, but should still be achievable. It requires that the user has set up an application through Google's API and provided the new calendar module its key so that the user's data can be accessed. This will be non trivial, but within the scope of the project and its timeline. If these goals are accomplished within an optimal time period, the ability to access shared or private calendars that the user has access to should already exist in the created codebase. Refreshing calendar data involves making another network request to the Google Calendar API and displaying the data it returns. This should be a trivial addition once code exists to initially download Google Calendars.

Enhancements

The enhanced version will build upon the bare-bones version by providing the following functionality: The project will combine Google Calendar and iCal calendars into one UI module and reauthorize the user so they don't have to sign in more than once. Merging the new Google Calendar data with the old iCal file data is a small problem. It will require formatting the Google Calendar to match the expected format the UI code would like it in. Re-authenticating the user's access to Google Calendar is nontrivial; it will require generating another OAuth token from their configuration and updating the system to use that OAuth token for requests instead of the expired one.

However, there may be unforeseen limitations in the Google Calendar API that prevent generating OAuth tokens in such a way, or that enforce limitations on how many times the program can use a client's application key before they must provide a new one. For these reasons, this approach may not be practical, and it may be necessary to instead engineer another workaround to OAuth expiry.

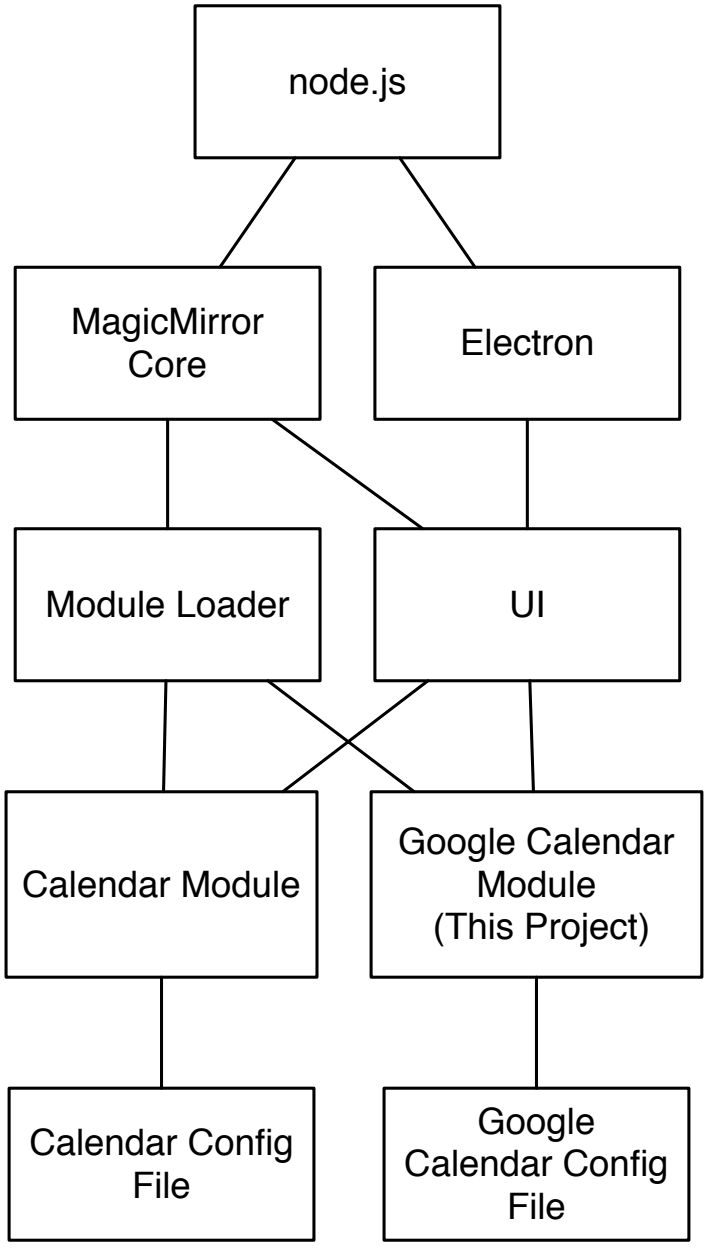
Conclusion

As of September 2016, the MagicMirror project website has almost 1,000 registered forum members. Over 2,000 people have starred the project source code on GitHub, and nearly 800 forks of the repository are publicly viewable. The potential user base for the improvements to this project detailed in this document is decently large. At this project's conclusion, the completed work will be listed as a pull request on the public MagicMirror repository to allow the original project maintainers to merge it into the greater project for all users. An open dialogue will be preserved to allow for further requirement completion if necessary to merge the additions.

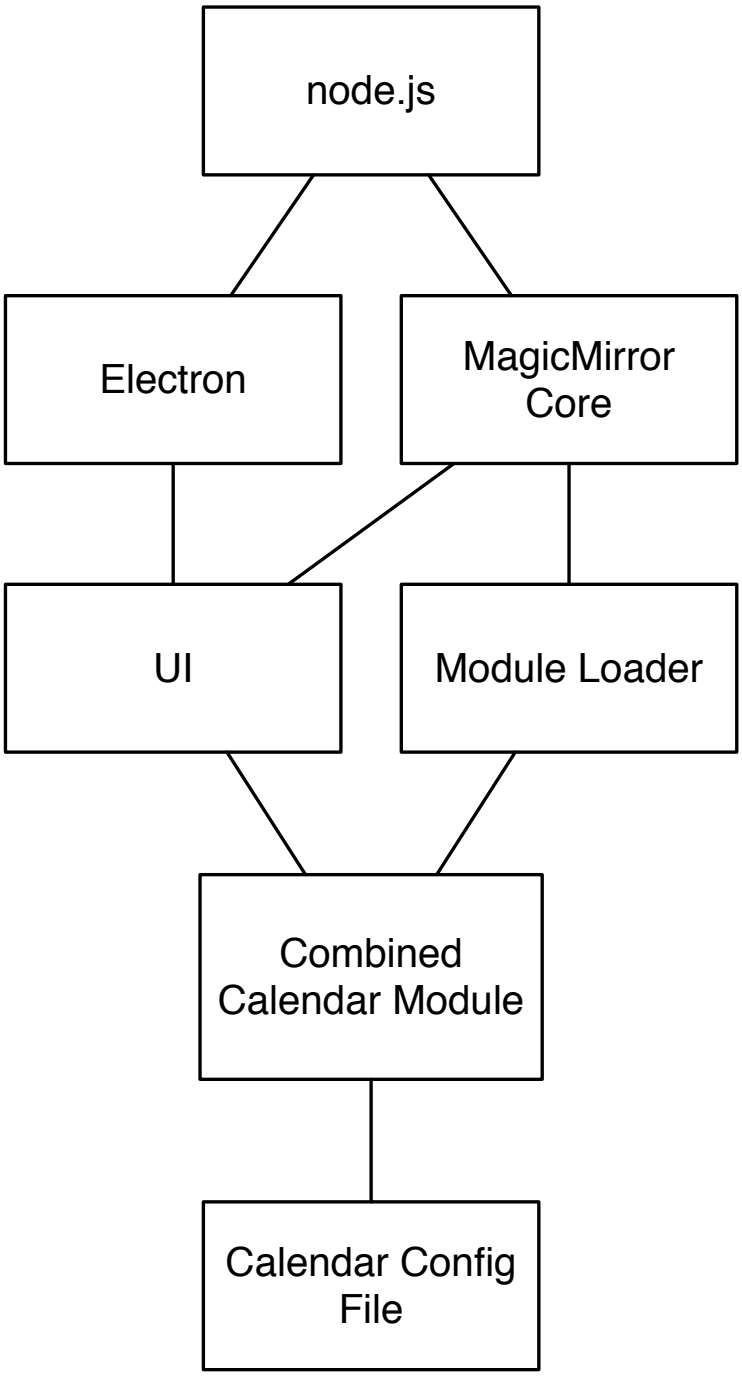
Native Google Calendar support will improve the user experience of MagicMirror as a whole, and will allow many people to use their calendars with the project who were unable to before. The benefits of this integration are immediately useful, and they have the potential to remain a part of the greater MagicMirror project for the foreseeable future.

Appendices

Appendix A: System Model for Minimum Requirements

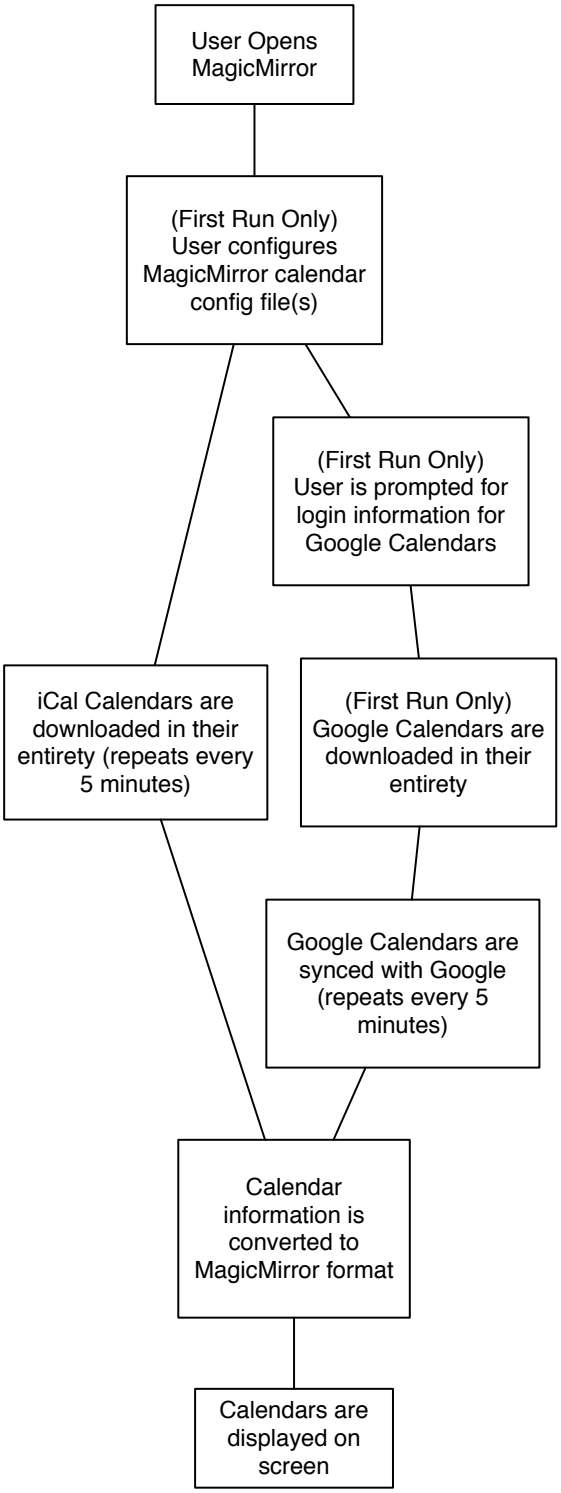


Appendix B: System Model for Enhanced Requirements



Appendix C: Use Case 1 Flow Chart

Appendix D: Use Case 2 Flow Chart



Metrics

Estimated Story Points

- Setting up the Development Environments (1 points)
- Setting up the Raspberry Pi Environment (2 points)
- Sample Project using Google Sample Code (8 points)
- Google Calendar User Story
  - Deciding on format and Creating Specifications for Google Calendar config file (5 points)
  - OAuth with Google Calendar (10 points)
  - Downloading Google Calendars Initially (20 points)
  - Syncing Google Calendars (10 points)
- Merge iCal and Google Calendar User Story
  - Ensuring Cohabitation of iCal and Google Calendar Config Files (10 points)
  - Merging UI Modules (10 points)
  - Merging Backend Modules (20 points)
- Trying to Merge with the MagicMirror Source Code (13 points)

Product Size

The current product size can be estimated using Product Effort, described in the next section, or by number of Story Points, described in the previous section.

Product Effort

The estimated product effort in terms of hours per person for this project has been broken down below:

Activity	Number of Hours
Environment Setup	10
Coding	80
Product Testing	20
Nonfunctional Requirement Implementation	20
Bug Fixes, Client Changes	30

Defects

As coding work on the project has not been started yet, no defects have been discovered.

Project Website

The Project Website can be found at the following URL:

https://thunderseethe.github.io/CS499/.

The project developers will post developer notes on the site blog during the creation of this project. Additionally, this document will be available on the site, and will be updated as the project progresses.