# SYSC 3010 Project Proposal

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**About Us**

We are the mirror men, a team consisting of Carleton Engineering students, Sever, Chris, and Eric who are dedicated to bringing The Morning Mirror to consumers everywhere.

**The Team Project**

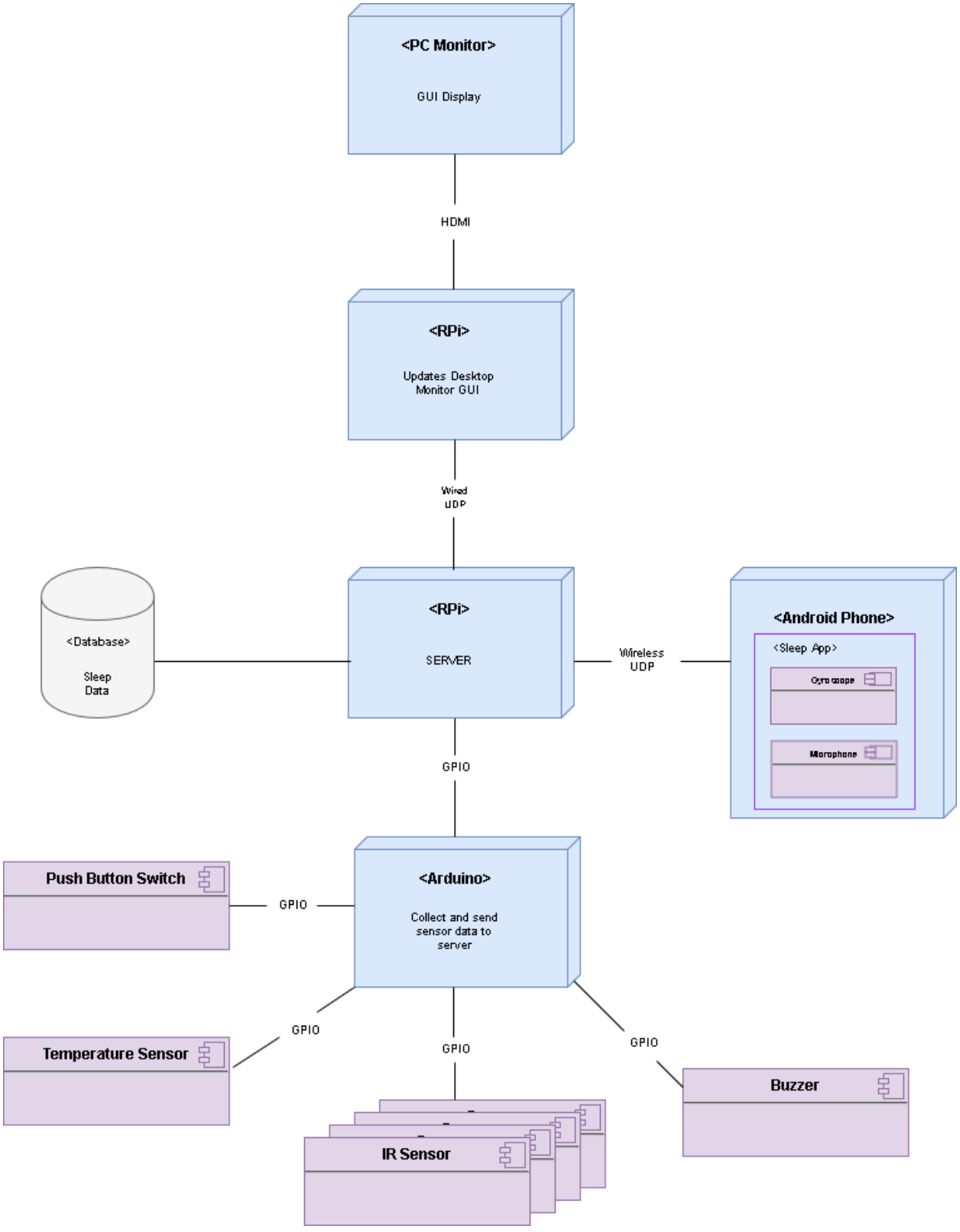
How many times have you missed your bus in the morning? Slept through your alarm? Wanted to read the news while brushing your teeth? If you're like us, this happens ALL THE TIME! This is why we, the mirror men, bring to you The Morning Mirror.

The Morning Mirror is a revolutionary new mirror which will transform the way you wake up. Say goodbye to those morning headaches, our mirror will monitor your sleep and wake you up while you're in non-REM (rapid eye movement) sleep. This will ensure you feel refreshed and most importantly, make it to where you need to be in the morning. The Morning Mirror will also make sure you get out the door on time because it will alert you when your bus is on it's way, making sure your bus isn't leaving as you're walking out the door. With this, and many more features, make your morning enjoyable. The Morning Mirror will make you want to wake up early!

The Morning Mirror will:

- Track your sleep and wake you up in the lightest sleep state
- Let you know the quality of the sleep
- Tell you when to leave in the morning to get you where you need to be
- Display the time
- Bring you the news
- Show you the weather outside and the temperature inside
- Integrate with an android app for sleep monitoring and setting alarms

## Team Project Design

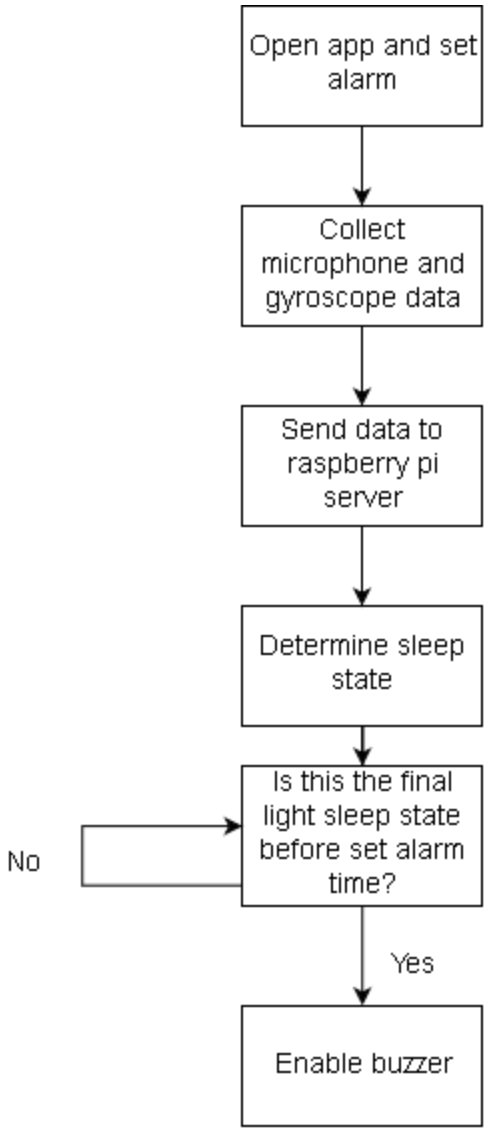


Functions of Sensors:

- The infrared (IR) sensors will be used to allow the user to interact with portions of the smart mirror.
- The temperature sensor will be used to display the temperature of the room.
- The buzzer will act as an alarm to wake the user up. It will force the user to get up in the morning and touch the mirror to shut off the alarm.
- The push button switch will be used as a switch to put the smart mirror in a sleep state, saving energy.
- The gyroscope will track how much the user is moving in bed during sleep.
- The microphone will track how much noise the user is making during sleep. This, in conjunction with the gyroscope, will be used to determine the sleep state.

**The Team Project Implementation**

Sleep cycle algorithm:



To implement a system that wakes the user up at the optimal time, an android app will be used. The app will primarily use the microphone to determine which sleep state the user is in. Humans go through cycles of sleep states. The cycle contains light sleep, deep sleep, and REM sleep. Each cycle lasts around 90 minutes. Knowing this information, and using the microphone and gyroscope of the smartphone, data will be aggregated and sent to the raspberry pi server. The server will then use the data to determine which sleep state the user is in. Once that is known, the user will be woken up during the lightest sleep state possible, while not elapsing the set alarm time. The flow chart above helps visualize this.

Data Structures:

No special data structures will be used for The Morning Mirror. However, a database will be used to collect the sleep data. The data will be written as plain text files. The sleep data, when needed, will be read from the text files.

Circuit Diagrams:

The following circuit diagrams will be used as a guideline to wire the sensors:

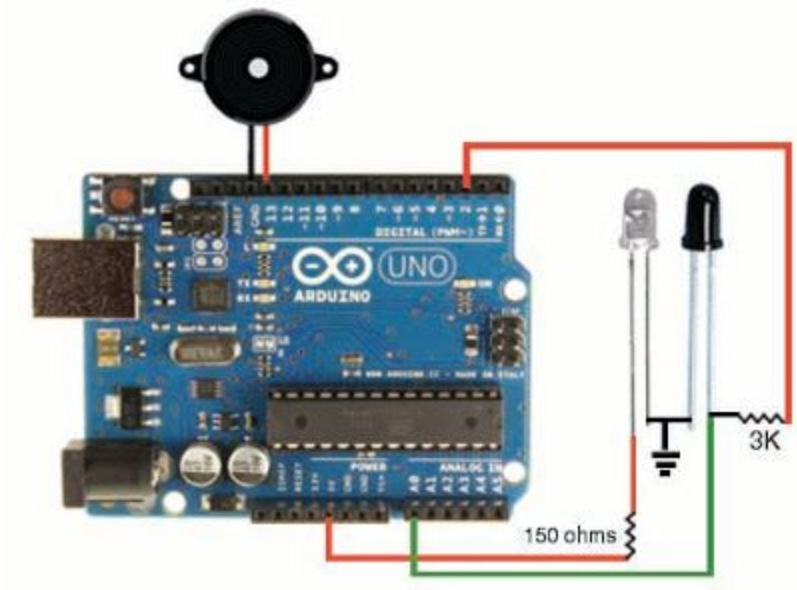



Figure 1: Circuit diagram for IR sensors and buzzer [1]

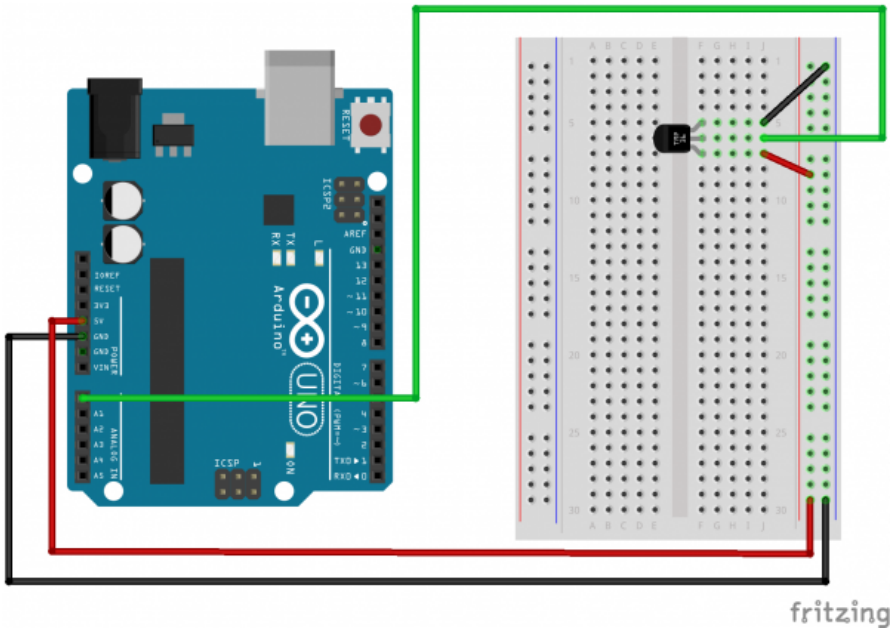



Figure 2: Circuit diagram for temperature sensor [2]

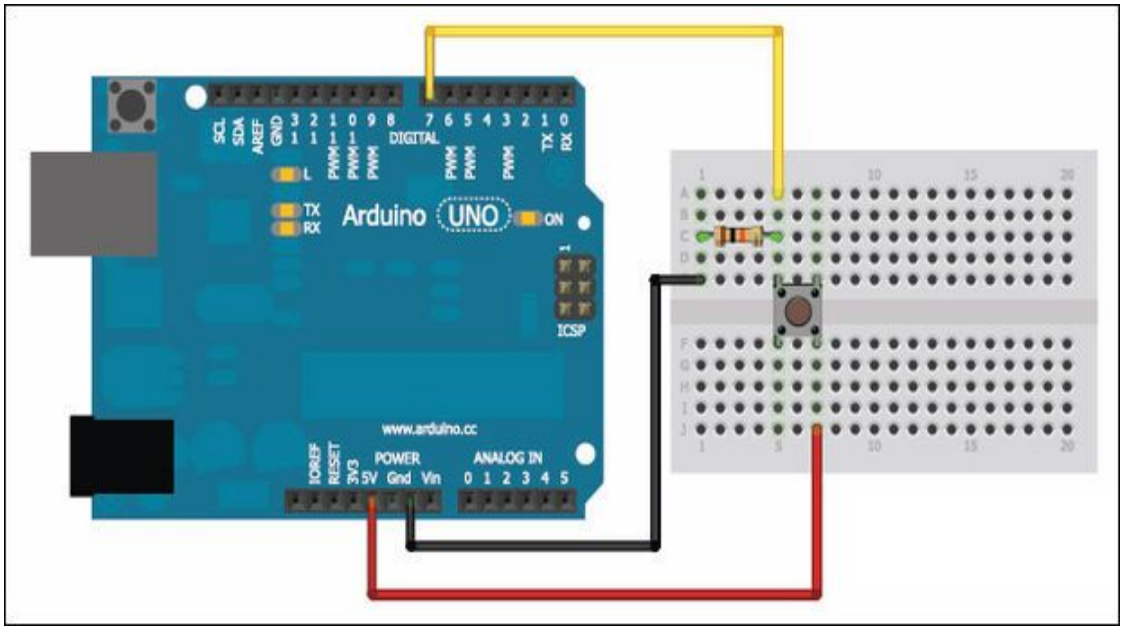



Figure 3: Circuit diagram for push button switch [3]

A resistor value of 10k ohms will be used for the push button switch. The buzzer does not require a resistor, but to be safe, a 1k ohm resistor can be used. The temperature sensor does not require a resistor.

**The Team Project Test Plan and Results**

All the features of the smart mirror will be tested individually, and later on, collectively. The features that must be tested are each of the sensors, the push button switch, and retrieving the data from the weather, traffic, news, and sleep monitoring system.

Tests:

1) The sleep monitoring system will require the bulk of the testing to ensure the system will start the alarm at the proper point in the user's sleep cycle. Different scenarios, such as not having valid data or receiving data, which makes the different sleep cycles indistinguishable, must be tested. The results of these must ensure that the alarm will still wake the user up at the desired time.
2) The push button will be used to put the smart mirror in a sleep state to save power. Doing so, must not affect other parts of the system. Also, when the smart mirror is reactivated, the system must go back to a normal state.
3) The temperature sensor will be tested for accuracy. A tolerance level of ± 1 degrees will be the goal. The temperature from the sensor will be compared to a thermometer and a weather app to achieve this.
4) The IR sensor will check if a user has selected a portion of the smart mirror to interact with. Thus, the IR sensor will have to be properly adjusted and programmed to ensure that the smart mirror responds appropriately. This will be done through trial and error to ensure the IR sensor work accordingly.
5) The buzzer will be set once the user needs to be woken up. Thus, the buzzer will be tested to ensure that it goes off during the appropriate time. This will be tested through mock scenarios to make sure the buzzer goes off. Testing will also need to be done when the sleep monitoring system algorithm sends a signal to the buzzer to alarm.
6) Data for the news feed, weather, and traffic will be collected and displayed on the smart mirror. First, the tests will include that the appropriate data is received. Then, the system must ensure that the data is properly displayed on the mirror.

With respect to collecting data from the internet, the connection itself will be tested by pinging certain websites. The integrity of the data must also be verified and changes will be made as necessary. Certain error cases will be simulated such as removing the internet connection to ensure the GUI from the mirror will handle the problem appropriately.

The temperature sensors, buzzers and proximity sensors will also need testing to ensure each acts appropriately in various different cases. These values will be verified using multiple boundary conditions to ensure proper functioning.

Collective testing will be done once the individual components are working. The testing will include retesting each feature individually to see how they react as a group. The testing will

ensure such cases will not affect other aspects of the mirror such as sounding the buzzer in the morning when the user interacts with the mirror.

**The Team Project Process**

Project Timeline


Roles and Tasks

Chris: Sleep Monitoring, Sensor Integration
Eric: Mirror Feeds, Temperature
Sever: Android application, Mirror GUI

**References**

[1] Kumar, K. (2013). *How to Use IR LED and Photodiode with Arduino*. [image] Available at: http://startrobotics.blogspot.ca/2013/05/how-to-use-ir-led-and-photodiode-with-arduino.html [Accessed 22 Sep. 2017].

[2] SIK Experiment Guide for Arduino - V3.2. (2017). [image] Available at: https://cdn.sparkfun.com/assets/learn_tutorials/3/1/0/Arduino_circuit_07_01.png [Accessed 22 Sep. 2017].

[3] Push Button. (2015). [image] Available at: http://www.instructables.com/id/5-Simple-Button-and-Led-Projects-with-Arduino/ [Accessed 22 Sep. 2017].