

About

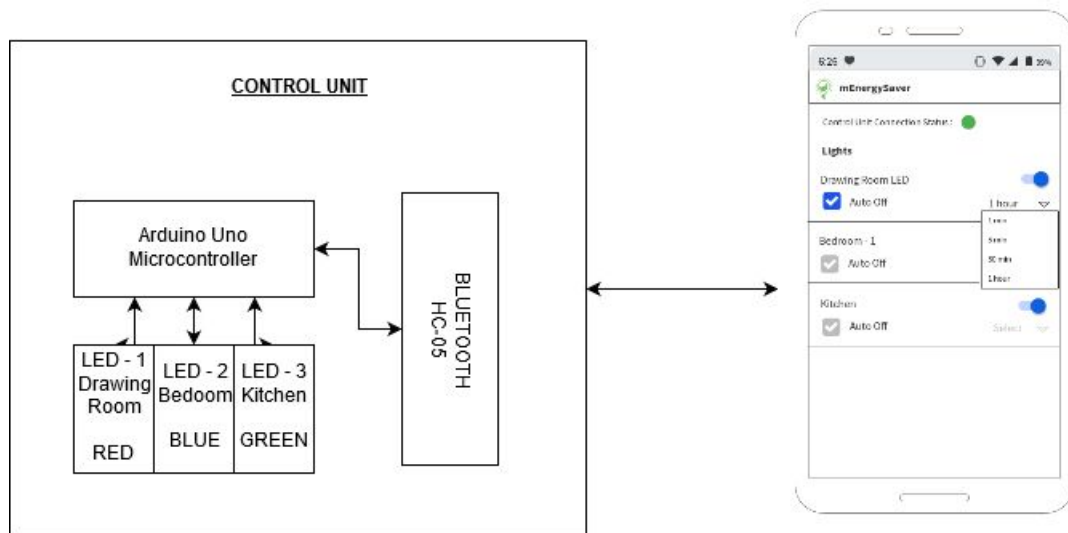
Smart Energy Saver (SES) is a bluetooth enabled, IoT capable, mobile application that aims to save power and energy in daily usage. The application demonstrates energy saving by connecting to a microcontroller circuitry which inturn controls a set of 3 LED(s), through a bluetooth interface. The application has triggers to turn on, turn off and schedule lights to switch off at a given(regular).

The whole system is a working prototype that lets a user build the circuitry and control the same using the Smart Energy Saver application. The application can be reused for any similar arrangement of control unit accepting the commands in the format that the application sends.

Design

Following sections would detail the design of the system and provide more details on the two major parts of the system.

System Overview



The system has two parts,

1. Control Unit
2. Mobile Application

Control Unit

Control unit is the hardware that drives the control over the LED(s) through a bluetooth interface. Control unit is made up of

1. Arduino board
2. Bread board
3. Resistors (1k)
4. LED(s) - 3 nos
5. HC-05 Bluetooth Module

Control unit also hosts the firmware that is flashed on to the Arduino board and listens to the signals from BLE unit to take actions on the LED.

Commands from the application are triggered and it reaches the firmware running on the microcontroller through the bluetooth module and takes appropriate action such as turning on and turning off LED.

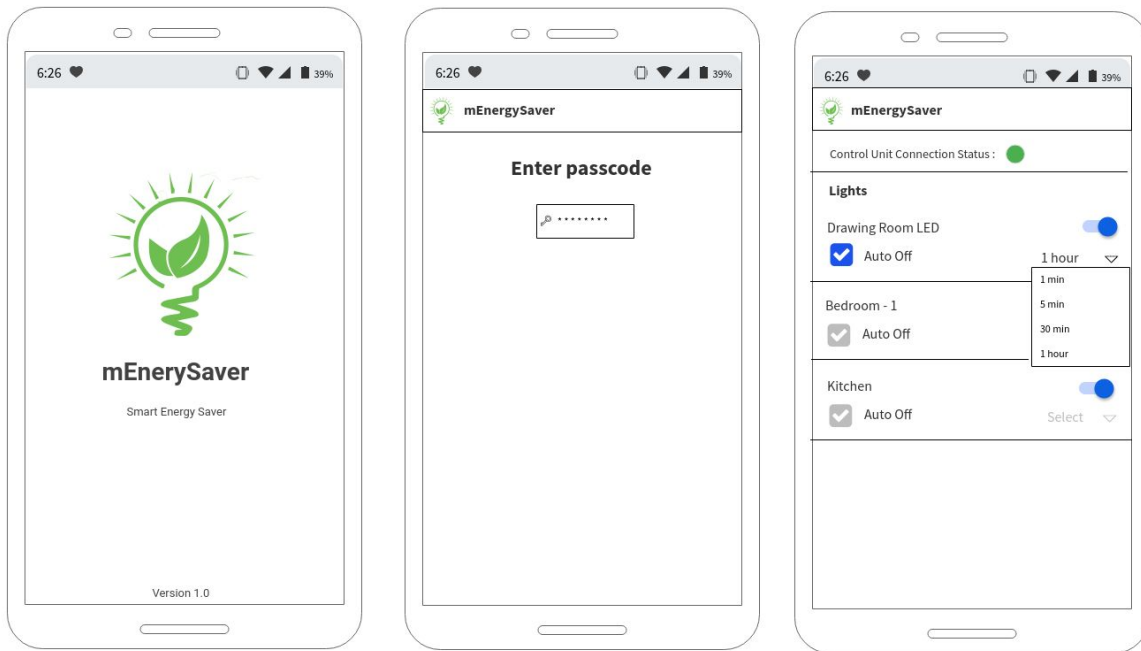
Mobile Application

The mobile application is a bluetooth enabled app to issue commands to the Control Unit to operate on the LED(s). The app lets control 3 LED(s).

1. App can simply turn on and off the LED using a switch
2. App can schedule turn off time while turning on a LED.

The mobile application also secures usage with the help of PIN that the user has to key in to use the application. This will protect the system from being used by unauthorized persons.

Following are the screen of the mobile application that has been built,



Commands sent by application,

Red LED

- Always On - **r11**
- Auto off in 10(s) - **r10**
- Auto off in 15(s) - **r15**
- Switch off - **r00**

Green LED

- Always On - **g11**
- Auto off in 10(s) - **g10**
- Auto off in 15(s) - **g15**
- Switch off - **g00**

Yellow LED

- Always On - **y11**
- Auto off in 10(s) - **y10**
- Auto off in 15(s) - **y15**
- Switch off - **y00**

Sync LED state (called each time the app is opened)

- **get**

Please note that all commands to the control unit shall be strictly as above and each packet of data must be 3 characters only.

Please find the source code of the application under the link provided under source code section.

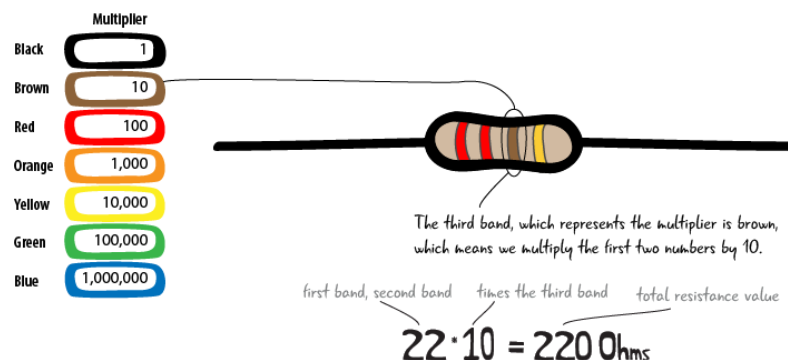
Circuitry and Components

The electronic circuit to connect the components is shown below with details connections,

PS: Need to update the circuit with BLE after few sessions

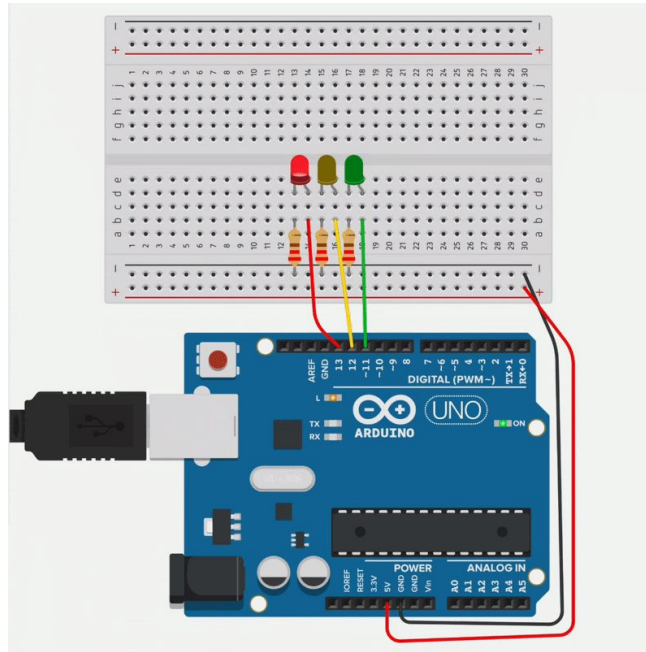
Components list,

1. 3 LED(s)
2. 3 resistors (220 ohm)



3. Male to Male wires 4 nos
4. Arduino Uno board
5. Power cable USB A to B

6. 4 Female to Male wires
7. HC-05 Bluetooth module
8. 1 Breadboard



Above is an example image of a breadboard and Arduino Uno

For more information on how to connect, please use the [how_to_connect.pdf](#) available in the source code repository

Flashing Firmware to Ardiuno

1. The control unit software can be built and deployed using arduino create editor application.
2. Install the application using the link in the software section.
3. Once the editor loads, program to control the LED(s) can be copy pasted from the source provided under source code section..
4. Once the code is ready, connect the USB A to B cable with one end to the computer's USB port and the other end to Ardiuno.
5. Once the device is detected, click on the upload button to upload the firmware to the device.

Please find the source code of the firmware under the link provided under source code section.

Source code

<Add GIT link>

Software Tools

<u>Tools</u>	<u>Purpose</u>
Arduino Create [https://www.arduino.cc/en/main/software]	To build and deploy the firmware
MIT App Inventor	To build and deploy the mobile application

Glossary

Firmware

Firmware is a software program loaded onto a device flash memory. It is programmed to direct instructions to communicate with other devices and perform operations like input/output tasks.

Circuitry or electronic circuit

An electronic circuit is composed of individual electronic components, such as resistors, transistors, capacitors, inductors and diodes, connected by conductive wires or traces through which electric current can flow.

Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

Arduino Create

Arduino Create is an integrated online platform that enables Makers and Professional Developers to write code, access content, configure boards, and share projects.

MIT

MIT App Inventor is an intuitive, visual programming environment that allows everyone even children to build fully functional apps for smartphones and tablet

HC-05 Bluetooth

HC-05 module is an easy to use ambient light sensors for wireless communication with SmartPhones, Tablets or any Bluetooth device.

IoT

Internet of Things (IoT) refers to the connectivity of physical devices that enables them to exchange data / information using a technology in which both communicating devices are capable of. Bluetooth is a technology, a communication technology in particular, which a developer can use to establish connectivity between these devices.