Switch-Easy

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Problem Statement

Smart home control systems are costly and can’t control all the devices in home.

Can we have an add-on solution to normal switches to make them RC?

Switch-Easy is a low cost and easy-to-use add-on to control the electrical devices with the existing circuit in households.

Tasks Involved

Create an application on the phone to interface a bluetooth module and send it signals.

Interface the bluetooth module with the TIVA board. This involves interpreting the signal received by the bluetooth module from the app and relay.

Taking the signal and then appropriately moving the actuator.

The actuator then hits the appropriate switch to turn it on and off.

Making the whole system an aesthetically pleasing plug and play tool.

Architecture

There are 3 parts in this system :

App - This controls the switches

Receiver - Each receiver communicates with the app and controls a switch box (up to 16 switches)

Lego blocks - Mechanical part that takes input from the receiver and switches on/off the light.Each switch has a single lego block. The length of the lego block is customisable

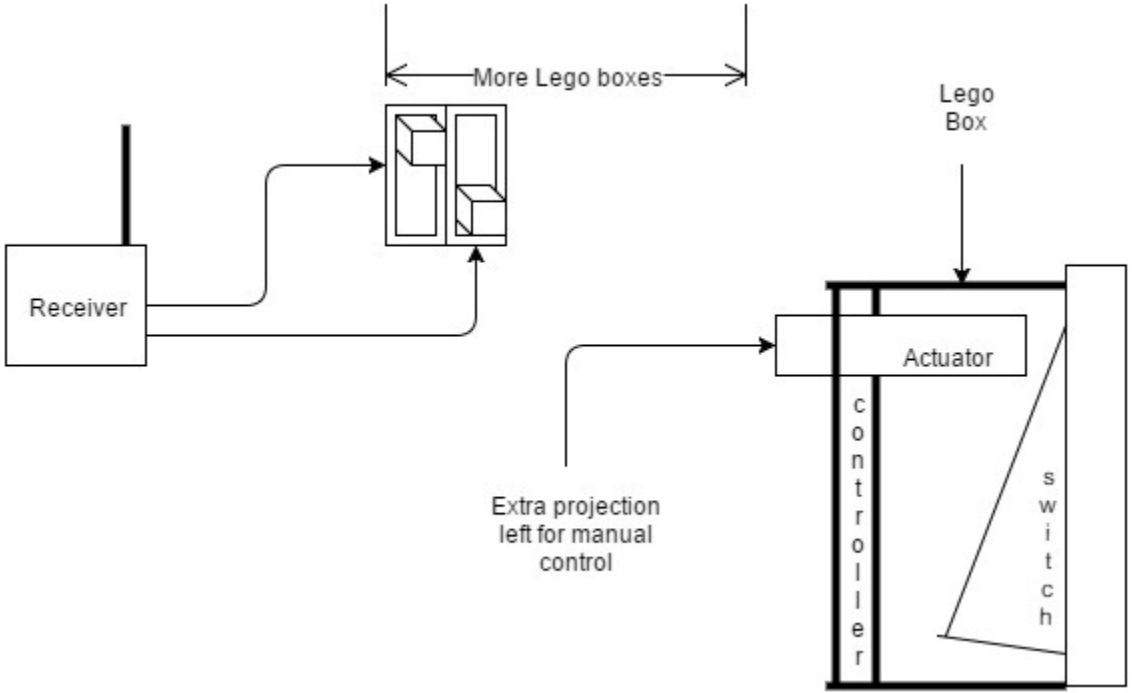
Project Plan

Critical Tasks	Completed On	Completed By
Interfaced TIVA board with servo	1st demo:	TP and Nitish
Interfaced bluetooth with TIVA	1st demo	Siddhant and Sai Charan
Made an android app to interface with bluetooth module	Final demo	Siddhant and Nitish

Project Plan (Continued)

Critical Tasks	Completed On	Completed By
Made a design of the lego block and soap case for 3d printing	Final demo	TP and Sai Charan
Extended interfacing for multiple servos	Final demo	TP and Nitish
Manually built soap case when 3d printing did not give required results.	Final demo	All four

Model


More Lego boxes
Lego
Box
Receiver
Actuator
Extra projection
left for manual
control
controller
switch

Sensors and Actuators

Bluetooth Module in the receiver

Actuators for controlling switches in the lego blocks

Challenges and Innovation involved

Designing soap case to handle both manual as well as automated switching

Building an autocad model for 3d printing and coming up with specifications

Using suction cups to attach device to accommodate for wall switch boards

Step Wise Progress

Tasks	Problems	Solution
Interfaced TIVA board with servo	Adjusting velocity and angle of rotation of servo	After trial and error we found the optimal value
Interfaced bluetooth with TIVA	Originally bluetooth module wasn't working and it took time to realize so we kept debugging needlessly. Finding baud rate of bluetooth module.	Tried on a new bluetooth module and it worked then.

Step Wise Progress

Tasks	Problems	Solution
Made an android app to interface with bluetooth module	No knowledge of android and bluetooth interfacing prior to this. Installing required tools. Making UI changes.	Went through documentation regarding bluetooth and android to make modifications to satisfy project requirements
Made a design of the lego block and soap case for 3d printing	No knowledge of AutoCAD, Solidworks or any such CAD tool. Taking into account switch size and positioning of servo in the lego block to hit the switch appropriately	Went through documentation. Took help from some Mechanical engineering friends to understand these tools. Came up with a design which we gave for 3d printing.

Step Wise Progress

Tasks	Problems	Solution
Extended interfacing for multiple servos	After 4 servos we need more pins on TIVA board to connect them	We extended it to two servos for prototype purpose
Manually built soap case when 3d printing did not give required results.	Serious time constraint since we realized that morning when 3d print came that servo could not fit in it. Had to now build one manually for demo purposes since there was no time to print again	Came up with fresh dimensions. Used acrylic to build the soap case and used glue and tape to place things appropriately. This required a lot of quick thinking.

Test

We mounted the switch cases and controller case on a switch board with two switches and successfully controlled the switches using phone. This verifies that the communication between phone and the microcontroller and also between microcontroller and switch case is working. It also verifies that the rotor is moving appropriately to toggle the switch.

Reusability Features

The switch holders are of plug-and-play model. So they can be removed from one switch and put on another. Also the holders can be plugged into each other making them space efficient.

A single TIVA board and bluetooth module can be used to control multiple switches.

Future Enhancements

Possible Extensions:

1. Our current model works for a limited range of switch lengths. The switch holder can be designed in such a way so that multiple switch lengths and sizes could be taken care of.
2. The motor remains turned on all the time which consumes more power. A possible extension would be to turn on the motor only when the bluetooth module receives a signal. This also ensures that all motors are not used all the time.
3. A single TIVA board could be used to control the whole house rather than onr board per each switch board.
4. Rather than using the power outlets of the switch boards, we can use more power efficient and user-friendly mechanism for power input.

Thank You