Phone-based Universal Remote Control

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Introduction

A phone-based universal remote control is a smartphone with infrared signal transmitting and receiving function. It can be used to control any infrared capable appliances. A transceiver is needed to give smartphone infrared transmitting and receiving function. The transceiver is divided into 2 parts, an emitter and a receiver.

According to the research by Nielsen in 2014, there are 87% citizens in Hong Kong [1] owns smartphones. Smartphones are the most common personal devices, thus by turning them into universal remote controls. Commanding appliances would become more convenient.

Design

A 3.5 mm plug is used to connect the transceiver and the smartphone. It is universal to all smartphone models but the signal input and output must be in audio format.
The main body is consisted of 2 LEDs and 1 infrared demodulator.

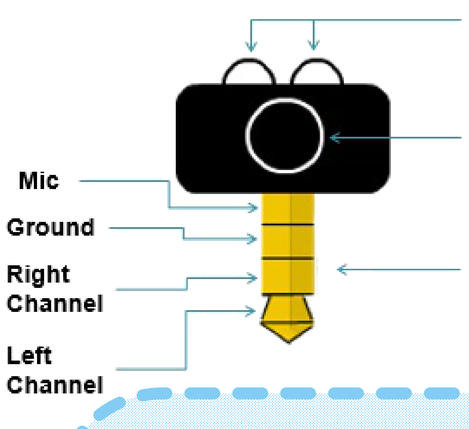

Fig.1) Transceiver design

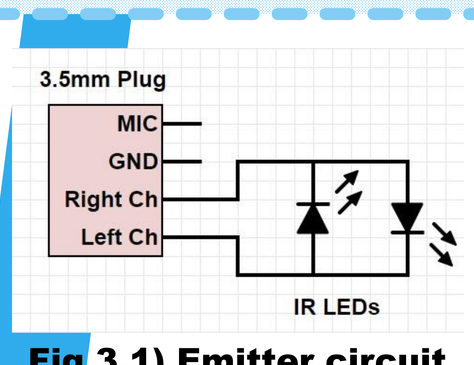

Fig.3.1) Emitter circuit

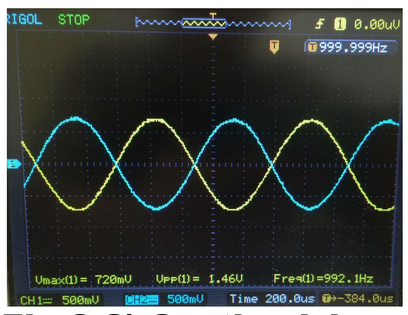

Fig.3.2) Synthesizing Out of phase sine waves

Emitter

Emitter is made of 2 infrared LEDs. It is used to transmit infrared signals. Smartphones' audio unit can only output a maximum frequency at 22 kHz. However, infrared remote signals required 38 kHz to operate. By using two infrared LEDS in opposite bias can double up the output signal frequency, therefore generating a 19 kHz signal can result in 38 kHz signal.

The emitter is successfully developed. Two out of phase sine waves are synthesized to supply enough voltage to LEDs. By setting the frequency at 19 kHz and proper on/off intervals, it can give commands to appliances.

Fig.3.3) Emitter appearance

App

The App is the brain and the user interface of the universal remote. It helps to synthesize and process remote signals. The user interface is the most important element of this project. It is aimed to give a superior user experience, so that it can eventually replace ordinary remotes.

The user interface is created to have a high flexibility. Users can customize the button layouts and download different remote models from the internet.

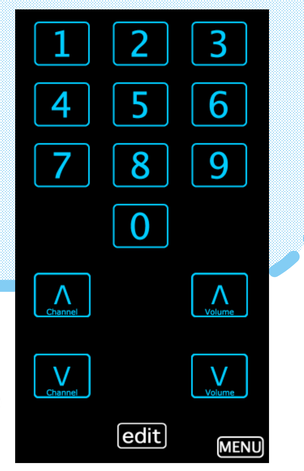

Fig.2) Control Interface

Receiver

Receiver is made of 1 infrared demodulator. It is used to receive infrared signals, so as to provide a code learning function. The infrared demodulator is used to demodulate the incoming infrared signal to remove the high frequency carrier. Hence, smartphones can sample the signal with the maximum sampling frequency 44.1 kHz.

The receiver can now sample infrared signals and record on/off durations with precision up to 0.03ms.

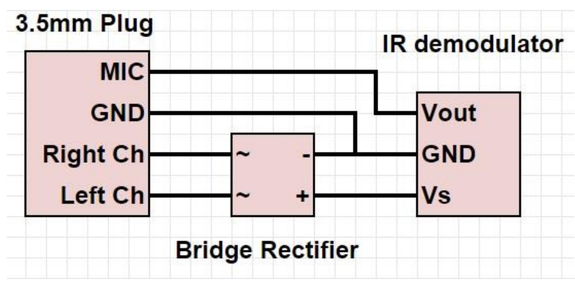

Fig.4) Receiver circuit

Conclusion

The phone-based universal remote control is potentially to replace ordinary remotes. Apart from ordinary remote's function, it has more benefits such as it can control multiple appliances, save plastic of manufacturing remotes and reduce the cost of producing remotes.

Reference

[1] Nielsen, "THE ASIAN MOBILE CONSUMER DECODED", 01-14-2014 <http://www.nielsen.com/ph/en/insights/news/2014/asian-mobile-consumers.html>

Acknowledgement

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