

Governing of Office Appliances using Teensy 3.6 with Infrared and Radio Frequency (RF) Technologies

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ABSTRACT In earlier days when there were no advent of modern technology tools, may be two or three decades earlier then now when serial ports were used for the purpose to interact with computer or as an interface but in now days when many of the new technologies are on the way computer engineers also updated the methodology of computer interface and replaced them with hardware boards having many of the vast functionalities that had helped allot to create many of the different projects for verities different fields like office application, home applications, automotive applications, health applications, environmental and military application and different commercial applications. In our project we are motivated to introduce a system that by using Radio Frequency sensors (RF), Infrared sensors (IR) by the help of Teensy UNO hardware board controls homebased appliance having power of 220 volt

Keywords: Teensy, Infrared (IR), Radio Frequency (RF)

INTRODUCTION

For the purpose of converting digital world from physical world so that it can be processed and stored and for communication purpose the sensors are in use that are small in size, low cost and give smart working efficiency with having an interface without wires.

Due to the actuator property the sensors had created power to be able to convert energy from source to source and make them as smarter as they can sense the outer or physical world. [6]. In many different areas mostly with large level technologies sensors has reserved their place like in [VLSI] and Micro Electro Mechanical systems [MEMS] at very large scale integration they are in use. Now days many of the different digital devices are in use like personal hand held devices, personal digital assistant, mobile phone, phone, access point with sensors without complicated wires they receive signals from radios. Due to the less amount of memory in sensors it was hard to store huge amount of sensed information and because of this lack of sensor radios make their place. Sensors contained battery as the basic power source, they are also capable to create energy from many other sources and rather than using allot of battery sources they consume energy from solar panels, e that depends on the area they have to be placed. These kinds of applications had facilitate people so that they can remotely approach their devices and other home based

systems. It was 2005 when very first Teensy were introduced. The micro-controller is the chip that have the capabilities of input, output, processing and memory. For the purpose of controlling the physical devices and fill an interactive object with sensing and controlling capabilities digital devices and microcontroller based kits had been introduced that supports to build digital devices. These devices had been created and designed by a company named Teensy genuine. While an astronomer named Sir William Herschel introduced the infrared, Radio Frequency Technologies and the infrared radiation (line of sight). In the year of 1800 [8].

If talk about Radio Frequency Technology it is the electromagnetic wave frequency that is present in the range outspreading from around 3 kHz to 300 GHz [8]. Noise, transmissions and interfering signals. The great range can be gain by ground waves, tropospheric spread out and sky waves then line-of-sight propagation. The radio spread permits estimates of valuable range to be made.

Every Teensy has a diverse operating voltage, digital and analog pins as they are designed for the several functions. If talk about Teensys the most in use Teensy board is UNO Teensy that is cheaper microcontroller having open source hardware, it contains ATmega1328 with the operating voltage of 5V having digital 14 I/O pins from which 6 has the capability to provide PWM output with 6 pins of analog input. Shown in the figure below 1.



Figure 1: Shows Teensy Layout

Use of Virtual Wire

Radio Frequency senders and receivers are in use for interacting with Teensy by using Virtual Wire communication library by using this library attributes like short messages having exclusive addressing, sending and acknowledgment can be taken and for the purpose of speeding up interaction and sending of data by using wireless paths and by applying ASK (Amplitude Shift keying).

Use of Relay

For the purpose to control Alternate Voltage to Direct voltage an electronic component is used called Relay that contains three connections shown in figure #2. That are [Normally Closed Connection, No Normally Closed Connection and Common Connection] from these connections for the end connection that to be controlled through Teensy 5v No Normally open connection is used.

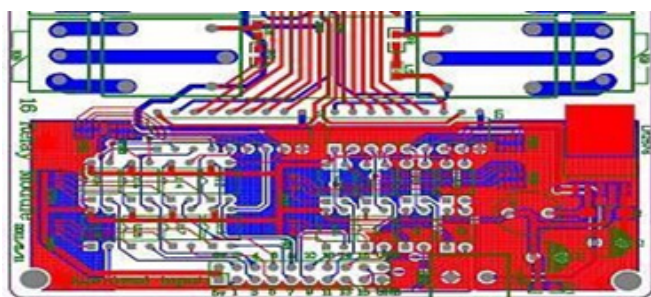


Figure 2: 5 V Relay Module 2 Channel

SYSTEMATIC LITERATURE REVIEW

Mathol [10] has designed a system for controlling appliances including AC, TV by using Teensy. The study provided a way of designing a flow that can use for better execution of the entire appliances systems. As, it is a demand of today because most of people are preferring the system that can access ubiquitously so Tal Ban [11], [12] and [13] has expressed the importance of such systems like Fan and AC controlled from the home and office and surveyed better circuits except teensy but Soni [14] and Creto William[15] used the teensy and shown that it is quite better than other circuits and this points lead us to deploy this mechanism via teensy. In addition to, we have not found teensy in prior research and this one is also reason to work with teensy.

STUDY AREA

It is not simple to operate homebased appliances with computer-based devices for this you have to be able enough to control electrical engineering and computing devices.

To control home appliances like AC, TV, Fridge, Washing Machine, Tube Light Bulb, Saver, Fan that uses serial and parallel ports or many other different interfaces with Wi-Fi, GSM, Line of Sight, Bluetooth with same area based or

remote network or internet connections and for various other devices many of different methodologies has been introduced. A system that introduced the controlling of devices on voice command which have an efficiency of monitoring one home appliance with one speech recognition-based home appliance [14].

Like for the disable people technology had been proven as the blessing the intelligent wheelchair were created that could be in control of disable persons and that was invented by using HM2007 chip [2]. Various different companies that manufacture cars uses Teensy boards that facilitate cars with multiple functionalities. [6]

DESIGNED MODEL AND ITS WORKING MECHANISM

IR and RF Designed Model

For the purpose of encoding signals Teensy board receiving transmitted signal from IR Remote Control (Transmitter or sender) and RF (Transmitter or sender) are in use by connecting IR Receiver and RG 233MHz. The next step is of decoding the signals with IR Remote .h library and RF Remote h library. The comparison and decoding process work based on defined value and after comparisons when matching occurs the relay starts working and produces the input output functions like switching on/off. By using three home appliances that are zero-watt bulbs, 100-watt bulb and TV/LCD AC load comes in use for demonstration. For understanding which technology is used either IR Technology or RF Technology in display of status performed action a small LCD display is connected with Teensy.

For controlling the input and output or for switching like one zero, on off, high low of the digital ports. The functionality has been included in Teensy board for program mapping or sketching by using the Integrated Development Environment of Teensy.

In the figure 3: IR and RF Design Model 3.2 RF Transmitter Designed Model and in figure#4 RF Transmitter model has been defined. The numbers of analogue present are from 0 to 255. For the purpose of moving RF to IR Mode this model uses three push buttons that also controls the ON and OFF of the relay. For sending the signals to RF 433 receiver RF 433 MHz transmitter had used that uses DA,VCC and GND having 10, 5V+GND Teensy ports. The micro controllers been controlled by the program that loads in to Teensy ROM. For rapid prototype creation the easy way is to use solderless breadboard.

ALGORITHM AND EXECUTION FLOW

The below hardware must be set with serial port for use and algorithm will help to work properly.

```
#define HWSERIAL Serial1

void setup() { Serial.begin(9600); HWSERIAL.begin(9600);
}

void loop() {
int incomingByte;

if (Serial.available() > 0) { incomingByte = Serial.read();
Serial.print("USB received: "); Serial.println(incomingByte,
DEC); HWSERIAL.print("USB received:"); HWSERIAL.
println(incomingByte, DEC);
}
if (HWSERIAL.available() > 0) { incomingByte =
HWSERIAL.read(); Serial.print("UART received: "); Serial.
println(incomingByte, DEC); HWSERIAL.print("UART
received:"); HWSERIAL.println(incomingByte, DEC);
}
}
```

HARDWARE AND SOFTWARE REQUIREMENT

Hardware Specifications

1. Teensy UNO
2. IR Transmitter (Remote Control) and Receiver
3. Relay Module
4. 220 Watts Bulb and Buzzer
5. LCD 12x2
6. RF Module (433 Mhz) - Transmitter and Receiver
7. 220 WattsBulb and Buzzer
8. Button

Software Specification

- Teensy-1.6.0-Windows
- Virtual Wire External Library
- IR Remote External Library
- Fritzing

CONCLUSION

Controlling home appliance through inexpensive sensor result confirm that using higher power devices like lights bulbs, motors, Television TV, Air Condition AC, Washing Machine etc. It is not easy to work with high powered electronic devices which may be controlled using AC or DC current because of direction of flow of electrons, zero of high frequency, power factor, impedance, resistance etc. As we have designed an efficient circuit using Teensy UNO board for controlling home appliances, the working prototype of proposed IR and RF designed model using inexpensive Teensy Board and Relay to Control 220 Watts electric appliance (High Voltage current from AC light through Teensy 5 V).

REFERENCES

[1] W. H. Brouwer, W. Waterink, P. C. Van Wolffelaar, and T. Rothengatter, "Divided attention in experienced young and older drivers: Lane tracking and visual analysis in a dynamic driving simulator," *Hum. Factors*, vol. 33, no. 5, pp. 573–582, Oct. 1991, doi: 10.1177/001872089103300508.

[2] S. Komiya, M. Ishihama, ... T. T.-T. P. of the, and undefined 2010, "2B25 Motion Analysis and Control of Dual Wheel Vehicle as Human-Machine System," *jstage.jst.go.jp*.

[3] J. Yick, B. Mukherjee, D. G.-C. networks, and undefined 2008, "Wireless sensor network survey," Elsevier, 2008, doi: 10.1016/j.comnet.2008.04.002.

[4] J. Harbluk, ... S. L. the 3rd international driving symposium, and undefined 2005, "Performing e-mail tasks while driving: The impact of speech-based tasks

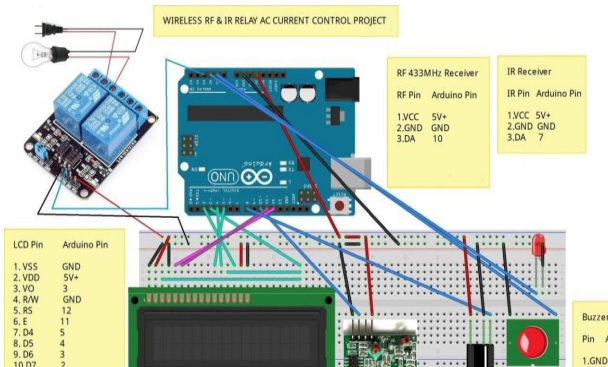


Figure 3: IR and RF Design Model

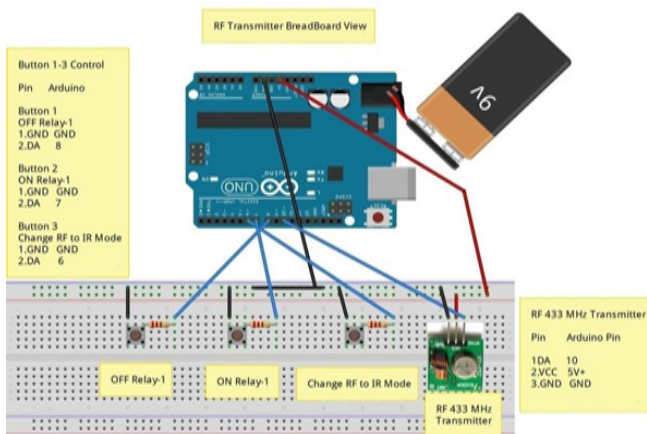


Figure 4 RF Transmitter Design Model

- on visual detection,” researchgate.net, 2005, doi: 10.17077/drivingassessment.1178.
- [5] T. Nakano, “Flexible shortcuts: Designing a new speech user interface for command execution,” *Conf. Hum. Factors Comput. Syst. - Proc.*, pp. 2621–2624, 2008, doi: 10.1145/1358628.1358729.
Wikipedia. Infra and Radio, Wikipedia, 2020
- [6] Z. Hua, W. N.-P. of the 2nd international conference on, and undefined 2010, “Speech recognition interface design for in-vehicle system,” *dl.acm.org*.
- [7] S. Tarbouriech, G. Garcia, and A. H. Glattfelder, “Lecture Notes in Control and Information Sciences: Preface,” *Lect. Notes Control Inf. Sci.*, vol. 346, 2007, doi: 10.1007/978-3-540-37010-9.
- [8] Nadeem, A.,K, Mujeeb ur Rehman,J, Ghulam,M., Farhan,A.,S., (2020), Controlling of Home Appliances using Arduino UNO Board with Infrared (IR) and Radio Frequency (RF) Technologies, *IJATCSE* September ,9 (5).
- [9] Y. Mathov, T. Ben Senior, A. Shabtai, and Y. Elovici, “Stop Bugging Me! Evading Modern-Day Wiretapping Using Adversarial Perturbations,” Oct. 2020.
- [10] T. Ben Senior, Y. Mathov, A. Shabtai, and Y. Elovici, “Stop Bugging Me! Evading Modern-Day Wiretapping Using Adversarial Perturbations,” Oct. 2020.
- [11] M. Jukl, S. Lacković, and F. Pregernik, “Radar transmitter and two targets simulator for surveillance radar system,” *Proc. Elmar - Int. Symp. Electron. Mar.*, vol. 2016-November, pp. 155–159, Nov. 2016, doi: 10.1109/ELMAR.2016.7731776.
- [12] G. Soni and S. Kandasamy, “Smart garbage bin systems – A comprehensive survey,” *Commun. Comput. Inf. Sci.*, vol. 808, pp. 194–206, 2018, doi: 10.1007/978-981-10-7635-0_15.
- [13] V. Cretu, “IOT Atmospheric Gas Sensing Aerial Vehicle.”
- [14] S. Williams, “Distance-Based Formation Control using Decentralized Sensing Distance-Based Formation Control using Decentralized Sensing with Infrared Photodiodes with Infrared Photodiodes,” 2021.