A Modern and Versatile Race Start Timer

by:Kevin Goom of Marine Modellers Montreal

Introduction

I have found it remarkably difficult to find either a design or a commercially available versatile and easy to use RC sailboat race start timer. I built one 14 years ago, but was based on a bare bones audio file player using an obscure and difficult to implement audio file format. Furthermore, it was interfaced to a microcontroller, and required considerable custom programming effort.

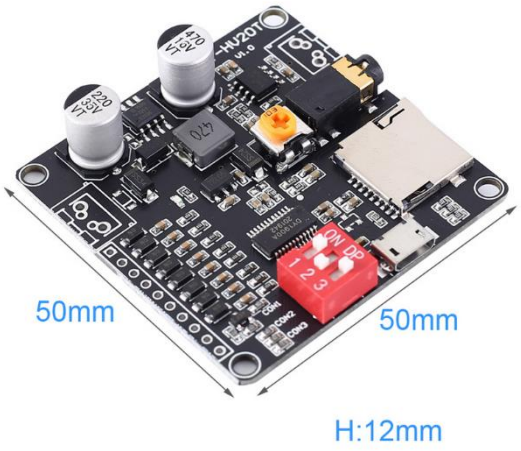
I set the following requirements for a new unit which made best sense to me, and would meet the needs of our sailing club (Marine Modelers Montreal).

1. At least 5 user selectable start sequences
2. Fully self-contained – no other hardware required
3. Simple to use. Turn on once per session, 1 button press per race
4. Sufficient volume to be heard by a group of unruly sailors on the waterside
5. Audio files easy to install and in a common and easy to edit format
6. Internal rechargeable battery
7. Display of battery voltage and remaining capacity
8. Buttons for Test/Reset and Start/Restart
9. Charging jack and external charger
10. Volume knob
11. On/Off switch

Core Hardware Selection

An extensive internet search revealed a module, DY-HV20T, that seemed to be perfect as a basis for the design. It has the following desirable features:

1. Readily available from Amazon at a very reasonable price
2. Audio files saved on a removable micro-SD or TF card in .mp3 or .wav format
3. Onboard audio amplifier with 10W output into a 4Ω or 8Ω speaker at 12V
4. Can be configured to play any one of 8 audio files by simply grounding a particular pad
5. Onboard volume control



A datasheet can be easily found using an internet search for “DY-HV20T datasheet”.

Other Hardware

Speaker and enclosure

I found that the cheapest and most convenient approach was to buy a ready-made enclosure containing a speaker. Since the audio is simply spoken words, there is really no need to be concerned about high fidelity,

so a cheap-and-cheerful unit will suffice. I got mine for a few $$ at a secondhand store. It needs to be big enough to house a 4Ω or 8Ω speaker of at least 4" diameter as well as all of the other equipment. My box measures 10" high x 5.5" wide x 6" deep. I would suggest that this is close to the minimum sensible size for convenient building. In my case, the enclosure was fully glued together, so I had to cut out the back panel, and replace it with a removable one.

Volume Control & Switch
The DY-HV20T has an onboard 10 kΩ potentiometer for volume control, not exactly convenient for regular use. It is therefore necessary to desolder it from the board, add flying leads to the 3 now empty holes and connect to an externally accessible panel mounted unit. Some such potentiometers come with an integral on/off switch such at the "TWTADE wh138 10K Ohm Single Linear Taper Dimmer Potentiometer with on/Off Switch".
A separate switch and 10 kΩ potentiometer is a very acceptable alternative.

Push Buttons
2 external push buttons are required, one to Test/Reset and the other to Start/Restart. Each are normally open, momentary closure (i.e. non-latching) SPST types. Many styles and sizes are readily available.

File Selection Switch
Up to 8 different audio files can be played depending on which of 8 separate leads is connected to ground via a switch. This requires the use of a single pole 8 position (SP8T) rotary switch in order to access all 8 audio files. 12 pole devices are more common, and would mean that 4 positions do nothing. Fewer poles would just reduce the number of available selections.

Storage Card
All audio files are stored on a removable micro-SD or TF card. Files must be named in a specific manner: 00001.mp3; 00002.mp3; ……0008.mp3. The .wav format is an alternative. The card must be formatted as FAT32.

Battery
I chose to use a 1200mA-hr sealed lead-acid unit because of size constraints and ease of charging, A word of caution, **do not charge at more than 300mA**. The module is capable of being powered by 6 to 35V, but 12V seems to be quite adequate. A multicell NiMh battery pack would be a suitable alternative, but I would stick to at least 10 cells.

Battery Monitor
I chose to add a battery monitor to display the voltage and remaining battery capacity. This shows when recharging is needed. No battery type reacts well to over discharging. Below is an image of what I chose. It can be omitted since has no bearing on the functionality of the unit.

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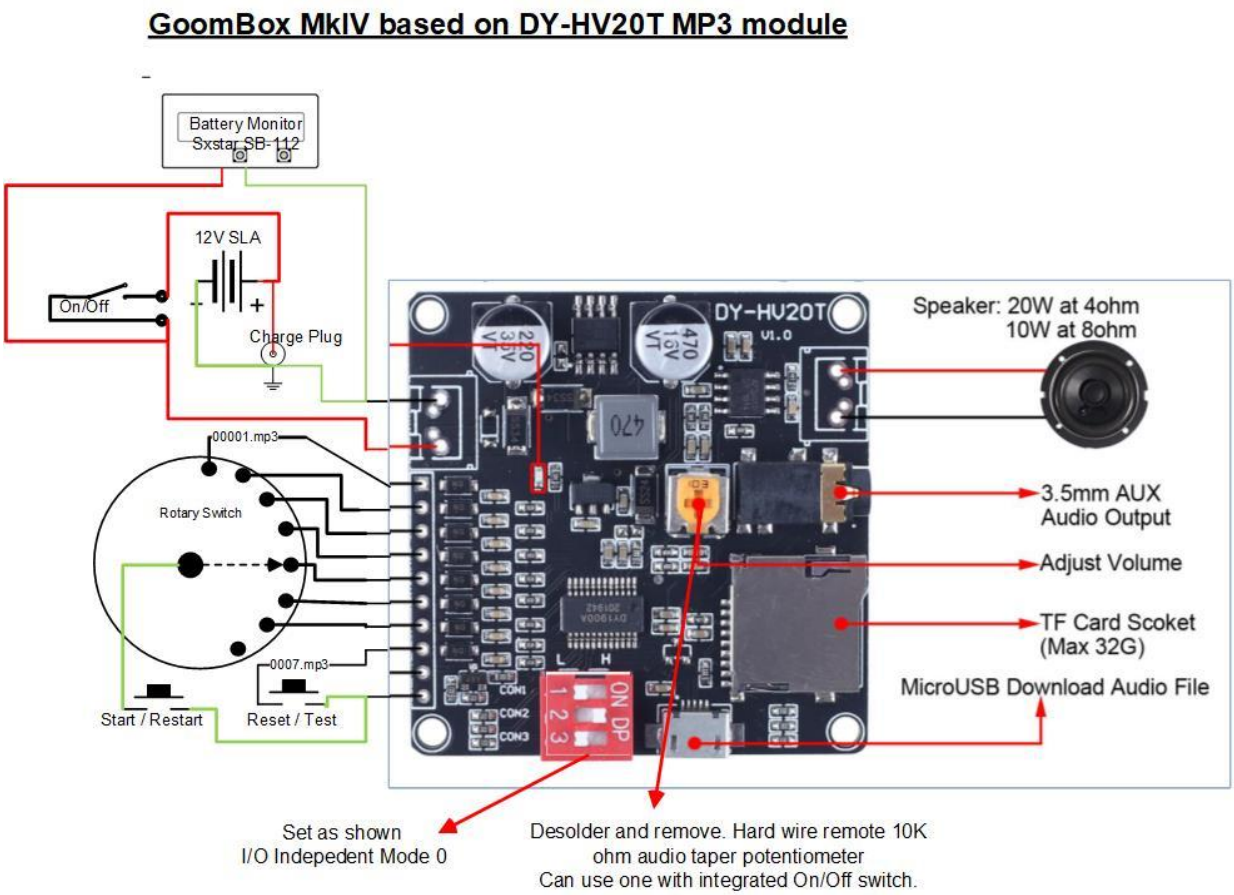
Battery Charger
I chose a Drok Buck Converter unit which offers the setting of maximum current and voltage output, and also displays output current and voltage. I set these to 300mA and 14.4V for the 1200mA-hr SLA battery. Input power was provided via a 19V DC laptop power supply. It is well suited to lead-acid chemistry, not so much for other types. There are many readily available hobby type chargers as an alternative.

Building the Unit

This unit does require some basic skills and equipment but is probably well within the capability of an accomplished hobbyist. The pictures following will give a better idea as to what is entailed in the build. Some basic woodworking skills will be needed when mounting the various component to. and within the speaker box.

A fine tipped soldering iron and basic soldering skills will be needed to make the numerous electrical connections. The schematic below provides an indication of the scope of the wiring.



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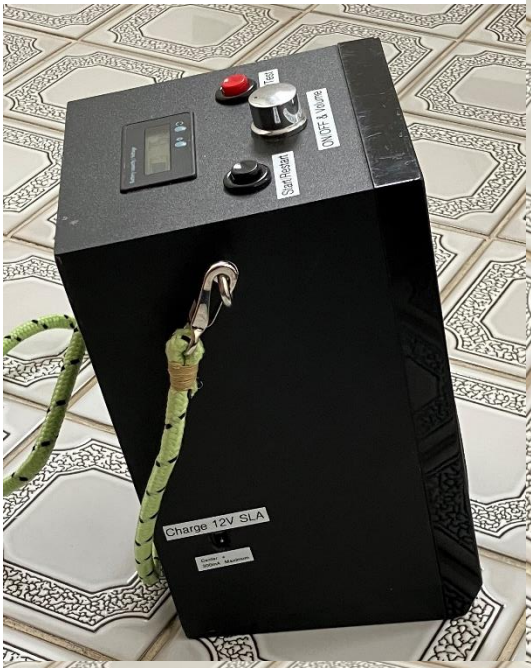

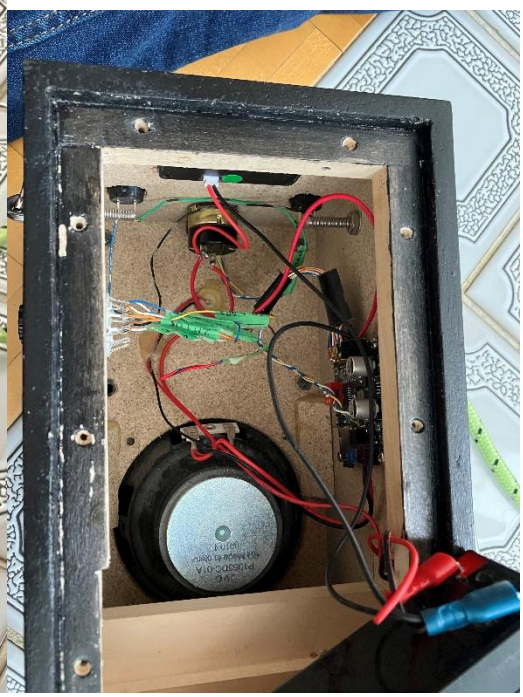

Conclusion

I hope that I have provided sufficient information to enable many RC sailing hobbyists, particularly those skilled in building sailboats, to build versatile, easy to use and relatively inexpensive race start timer,