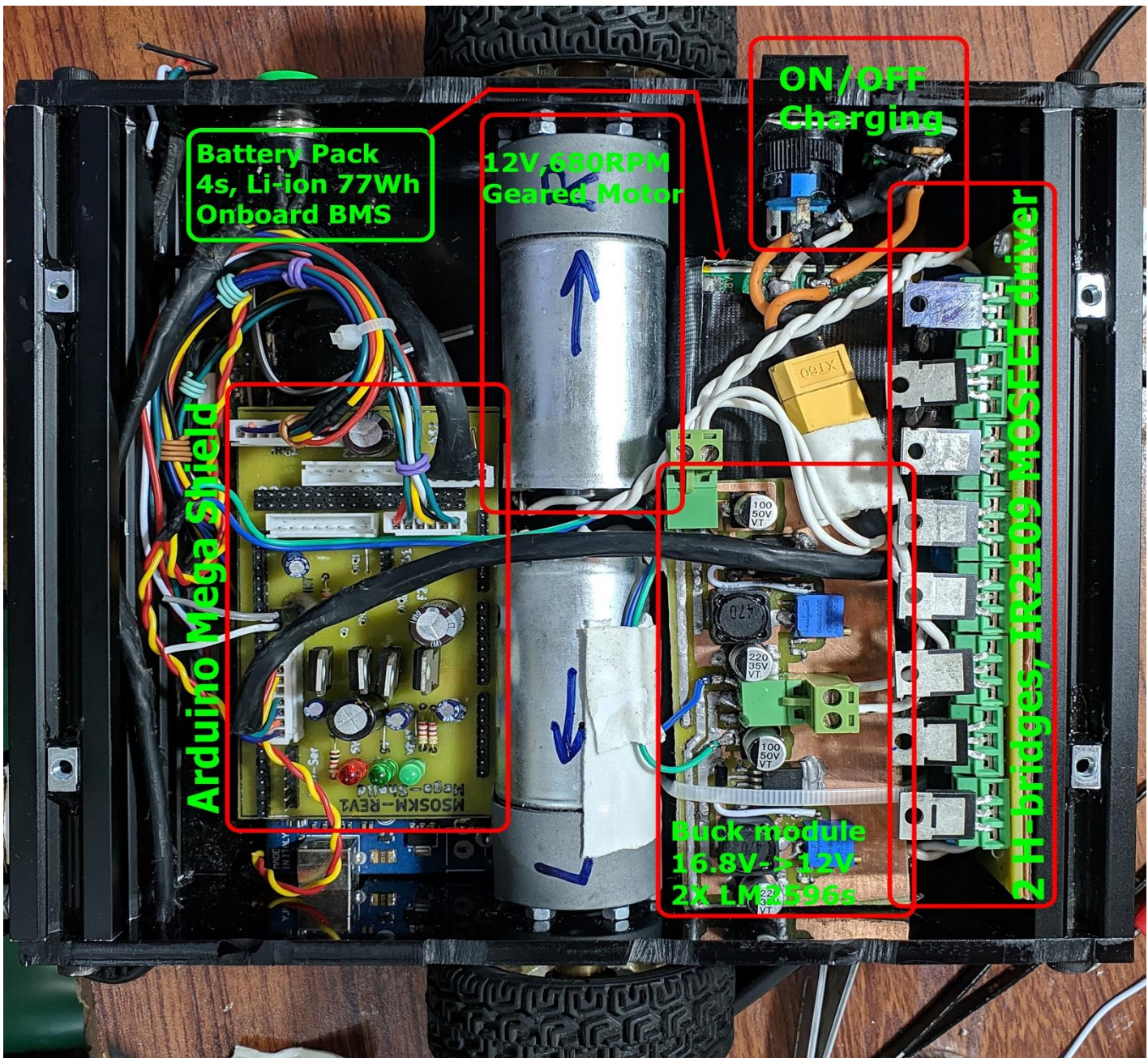


Electronics of Fruit Plucking Robot



Brief Introduction:

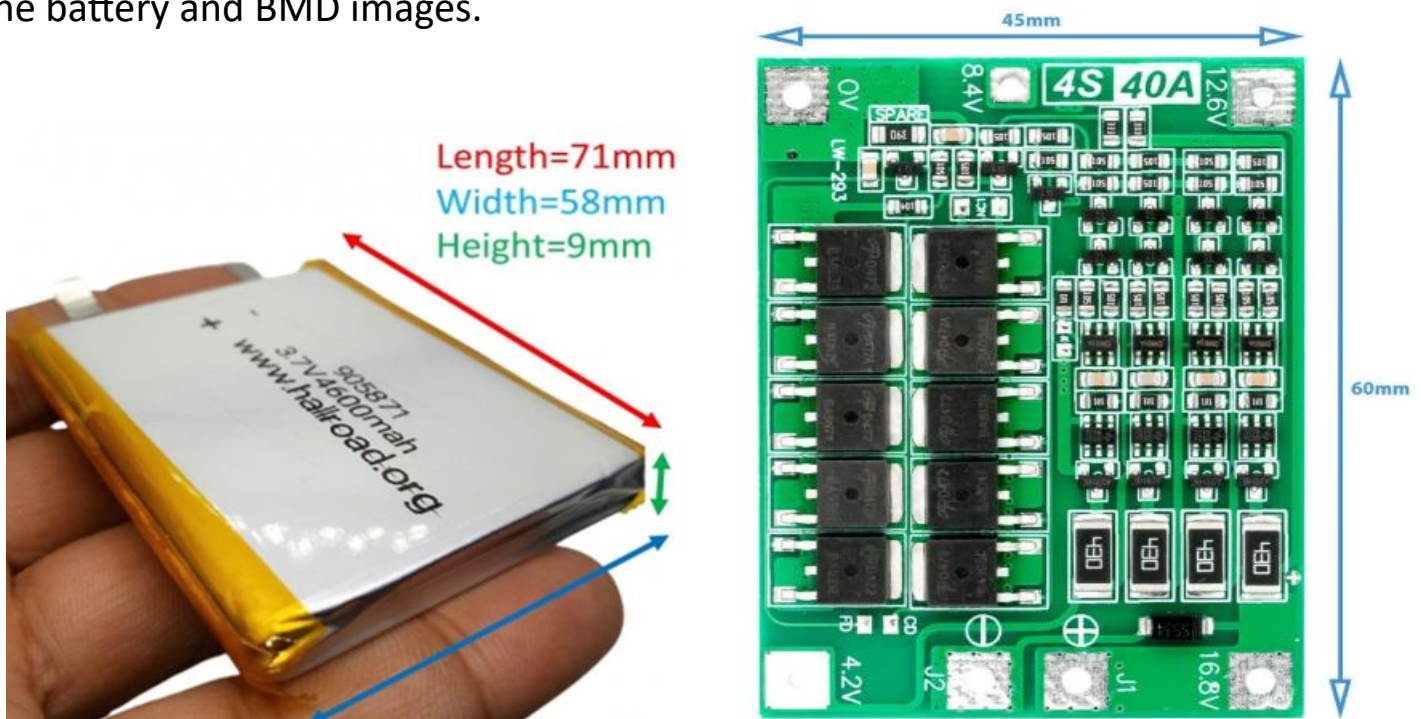
I am Kashif Khan (Kashifkhanwork726@gmail.com), One of the team members.

What I will be describing down below is all team decision and effort, I am just documenting this to help others, so they don't make those mistakes which we had. I will be talking about the following things:

- Battery pack.
- Arduino Mega shield.
- H-Bridge.
- Buck Module.
- Custom IR sensor strip.

Battery Pack:

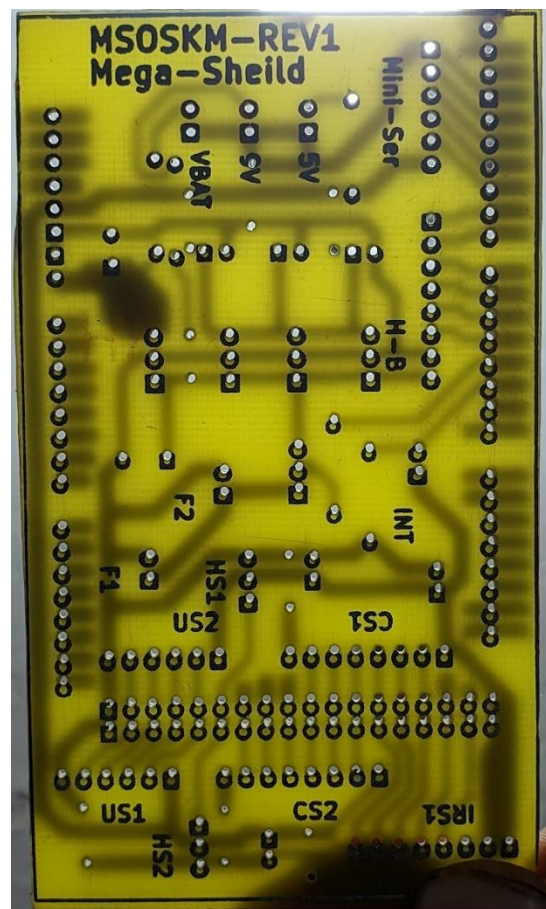
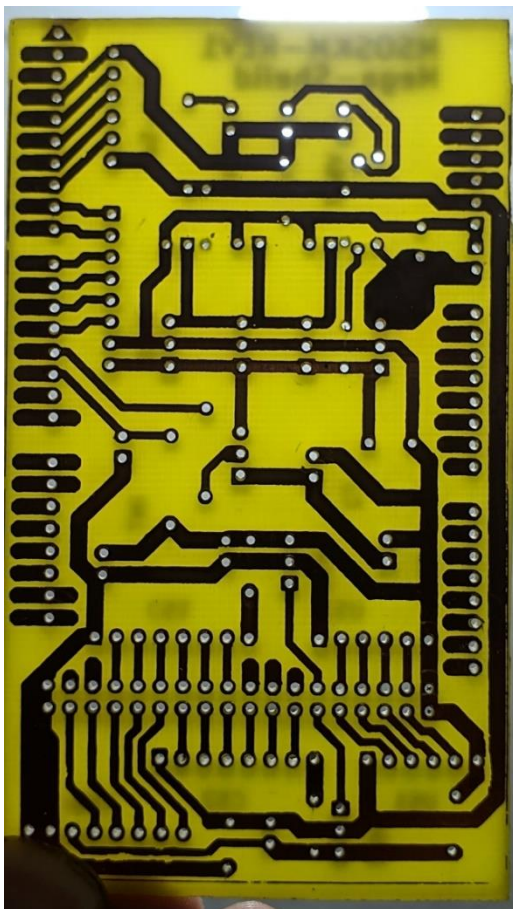
The battery pack is discretely made, we purchase separate 4 lithium-ion battery packs, with nominal voltage of 3.7 and fully charge voltage of 4.2V. A 4s battery management system, Wired the batteries in 4s configuration to the BMS. So, we get 16.8V fully charged and 13.4V fully discharged, the cut-off voltage for each cell was 3.3V by default in the BMS circuit which was according to our need. Then we packed the batteries and the BMS and taped them to secure them against any vibration and zip tied them to the base of our fruit plucking robot. Down below is the battery and BMD images.



Arduino Mega Shield:

This is very important to have in your design, since we have many things connected to our Arduino Mega like, 10 GPIOs pins for our custom designed IR sensor strip, 12 GPIOs for two color sensors, 6 GPIOs for all the servos, 8 GPIOs for 4 ultrasonic sensors and finally 5 GPIOs for the H-bridges. So, we decided to make permanent solution to hook all these wires somewhat professionally by using generic JST connector and make an Arduino Mega shield which will host all these connectors and some LDOs of 5V for servo and 9V for the Mega itself. So, we designed a shield that will sit perfectly right on top of the Mega and all the connector will easily accessible, and we can easily plug and unplug any thing in matter of seconds, We also did the silkscreen so we don't have to remember that which connector goes where, any one with a 1-bit of sense can understand the labelling and can deal with it easily. The shield was designed in KiCAD 6, project files are attached along with this document.

Down below is some of the manufacturing phase picture and some CAD snapshots.



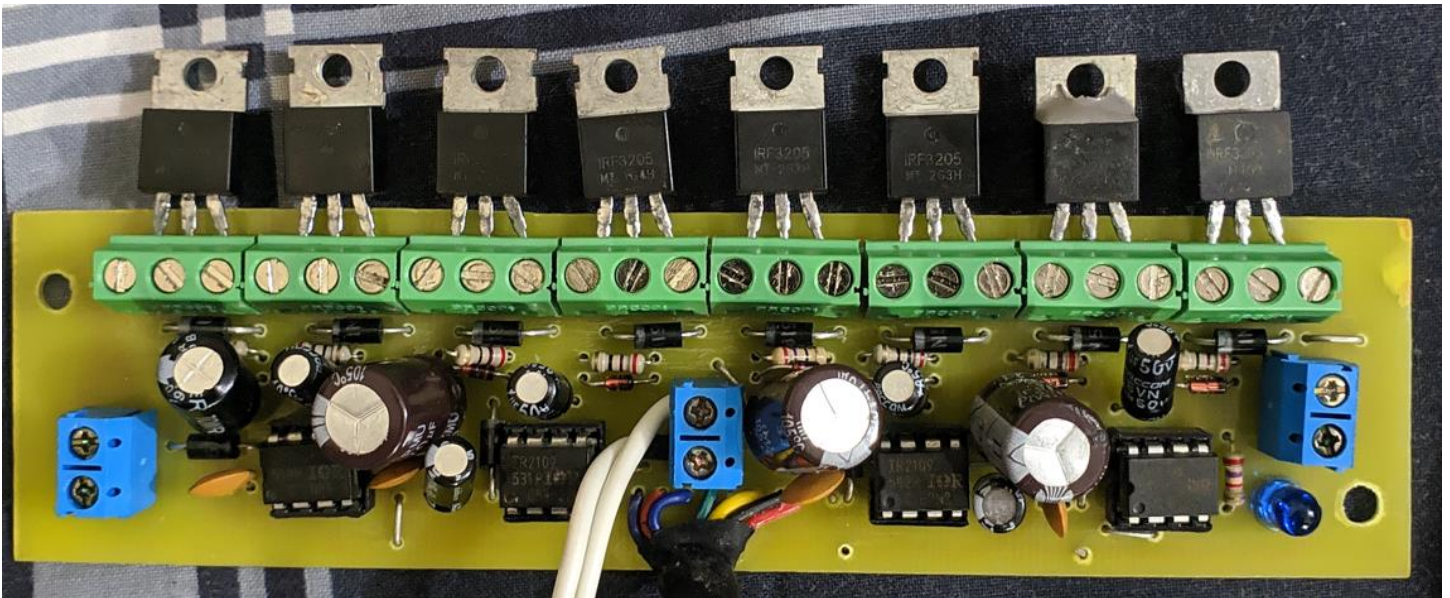
H-Bridge:

This was the relatively easy part in the whole project. So the motors we have had were rated 15W with no load at 12V, So two motor adds to 30W power draw and when loaded about 8kg (whole weight of the bot with mechanism) so the motors drew quite a lot of power >40W running at 200PWM from the Mega.

Seeing this much power I decided to go with MOSFET based h-bridge, since I did not have to use beefy heat sinks that will take a lot of room in the bot and make things more complex. And I did not have the space to fit all this in the bottom section of the bot. Thanks to my sweet 😊 friend Owais.

So going with MOSFET base H-bridge I decided to use dedicated MOSFET driver ICs to drive the MOSFETs.

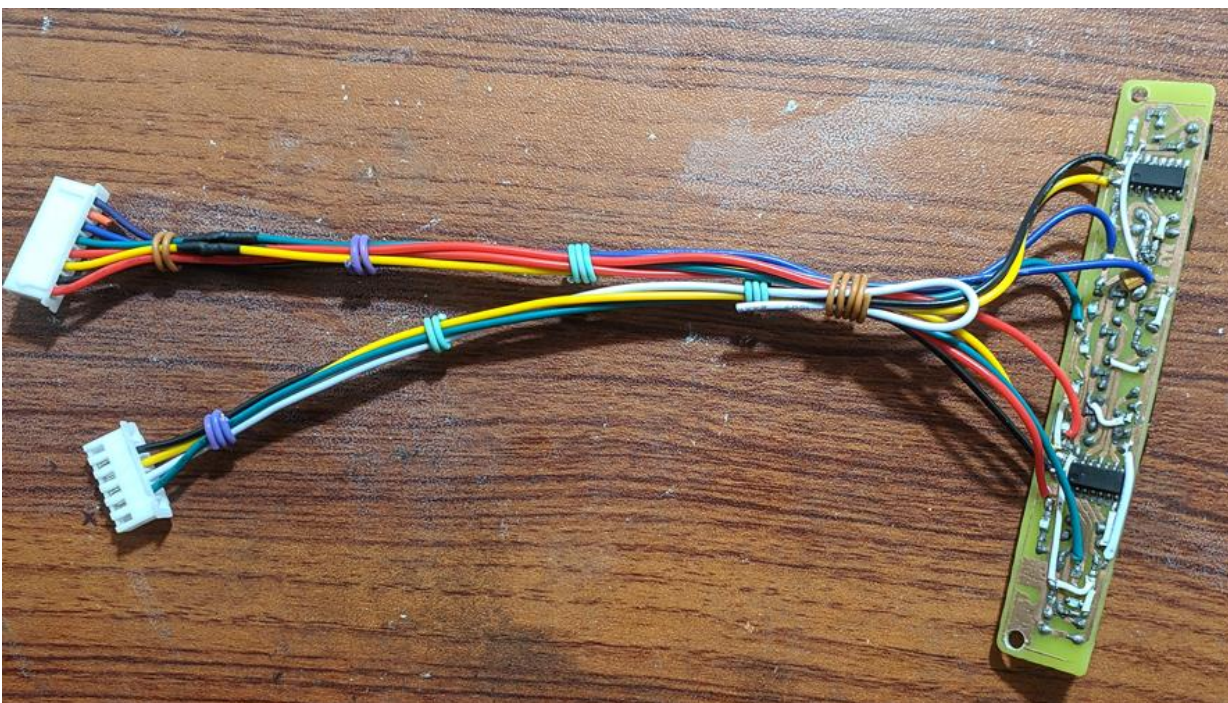
All the project files are attached with this document. Down below are some images of the final build of the H-bridge.



The whole size is, 20mm/165mm/15mm(W/L/H).

Custom IR sensor Board:

This was the most fun part of the project, for accuracy and precious reason our group decided that we should make a custom sensor that will make the bot run smooth and make the final adjustments facing towards the tree more reliable and more importantly fast. This helped us a lot in shaving almost 10sec from our overall finishing time. We had to do a lot of work in this a lot of hardware trouble shooting but, in the end, it was worth the effort and time. The design was all SMD components on a single layer board with 10 IR sensors facing downward sending digital data the Mega. Basically, we took the components off from already market famous but no so reliable sensor the TCRT-5000 and made or own MKMSOS-8000 sensor board 😊.



The size was 15mm/100mm(W/L).

Again, you will find all the design files with this document. Best of luck making this sensor board.

Just for a check, to know that you have read all this document. I will tell you a number and you must answer me another number so if both numbers are added the sum should be 20. If you answered this right, then my team will be available for any type of help.

Thank you! and best of luck for NERCs.