The Best of Best Invention

Description/summary of your invention(s)
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Invention Title: PEV - Personal Electric Vehicle

PEV **- Personal Electric Vehicle is a longboard-type device driven with 2 BLDC motors. Its main purpose is to quickly get from one place to another safely and with minimal effort. The invention is compact compared to electric scooters or bikes. If the device runs out of charge it's possible to use it like a manual longboard.**

The project is composed of:
-2 BLDC Hub motors, 600W each
-2 Electronic Speed Control (ESC) units rated at 40A each
-6 relays (one for each phase) combined with two chunks of aluminium acting as power resistors and an Arduino Nano MCU - coming all together as a fully original electrical braking system.
-90mm dia. wheels
-110cm longboard deck
-glass fiber casing containing all the electronics
-Lithium-Ion battery pack using Sony VTC5A batteries. Wired in a 6S4P (6 series, 4 paralell) configuration. Coming off as 219 Wh / 9.4Ah. The range is dependent on the riders weight, around 24km was noted for a 60kg human. The highest recorded speed was 21.7km/h.

Our fully original braking system is made of six route-switching relays alternating between two states.
First state: (when the throttle on the remote is tilted forward) - route switching relays are set to deliver power to the motor phases.

Second state: (when the throttle on the remote is tilted backward) - route switching relays connect motor phases to the power resistors, causing an electrical load for the motor that results in exqusitely reliable electrical braking.

ESC burning is a common failure when it comes to PEVs. Regenerative braking paired with back-EMF voltage bursts might cause the speed controller to completely fry and in need of replacement. Our system disconnects the ESC from motors during braking, making it impossible for the speed controller to cease function.

Our original electrical braking system is superior compared to regenerative braking, because during the process the motor is completely disconnected from the control electronics, making it impossible to damage hardware and is more consistent. Regenerative braking can't occur when the battery is nearly fully charged. Our braking force is directly proportional squared to the speed and we could additionally alter it with changing the tires to get better or worse traction. This solution has not been applied to personal electric vehicles, as far as we know, we were the first to implement it. Even though the device is not getting power back from braking, the deacceleration is way steadier, easier to predict and safer for the electronics, making the entire device more reliable and long-lasting. The braking distance from the full speed is around one meter - that result is impossible to achieve using regenerative braking.

Bill of materials:
-Battery pack: 497.8zł - 129$
-Dual Hub BLDC motors - 548.3zł - 142$
-Hobbywing XRotor 40A ESC x2 - 117zł - 30$
-MAH-4120 Relays, 12V 40A - 48zł - 12$
-Arduino Nano - 20zł - 5$
-Heatsink resistor - free
-Used longboard deck with glass fiber casing - 200zł - 51$
Subtotal: 369$
The commercial solution for a similar vehicle (at ex. ExWay x1) costs 600$ + shipping.

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[instruction of your invention(s)
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To use the electric skateboard, first of all, the key has to be inserted. This is the only way to turn it on. After the key was inserted, the device will begin searching for the remote signal. LEDs on the remote indicate a successful connection and tell the battery level. The remote has three speed modes (green - slow, yellow - medium, fast - red), that can be changed depending on the rider's experience. Each speed mode cuts off a part of maximum throttle making the vehicle less dynamic. When the throttle on the remote is tilted forward, the skateboard is driving forward. If the throttle on the remote is tilted backwards the brake engages. If throttle is left untouched the device is rolling freely. Turns and other manouvers are executed as with any other skateboard, leaning to the side makes the longboard turn in that direction. To charge the device it is required to pull the glass fiber casing off and connect a charger to the battery.
Use brakes only for a full-stop operation. Brakes apply immiediate force that drastically decrease speed - use with caution.

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[invention idea] Drawing/Photo A4 – 1page

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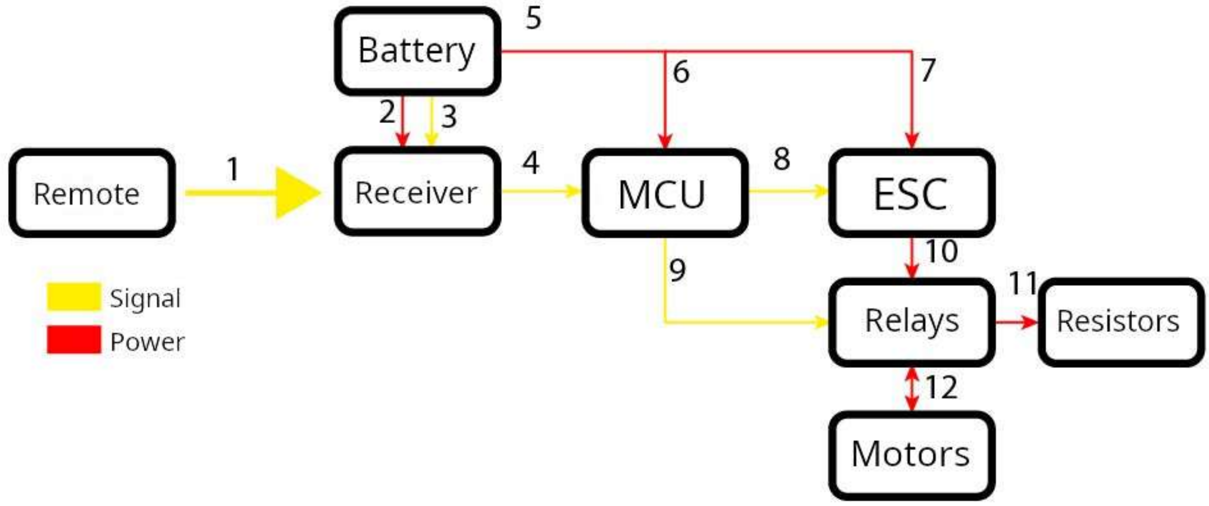
<Drawing>



1. The remote sends a radio signal to the receiver.
2. The receiver is being powered by a buck converter hooked up to the battery.
3. The receiver is hooked up to the main battery terminal for remote voltage readout.
4. Throttle signal is wired to the MCU.
5. The Battery is powering the ESC and MCU.
6. The MCU is getting 5V through the buck converter.
7. The ESC is getting full battery voltage.
8. The MCU is sending a speed control signal if the throttle is tilted forward.
9. The MCU is triggering relays if the throttle signal is tilted backwards.
10. If the relays aren't set, motor phases are connected to the ESC.
11. If the relays are set, motor phases are routed through a resistor, causing electrical braking.
12. Depending on the relay state, power is flowing in or out from the motors.