Self Balancing Single axle Robot

Team: Blue Thunder

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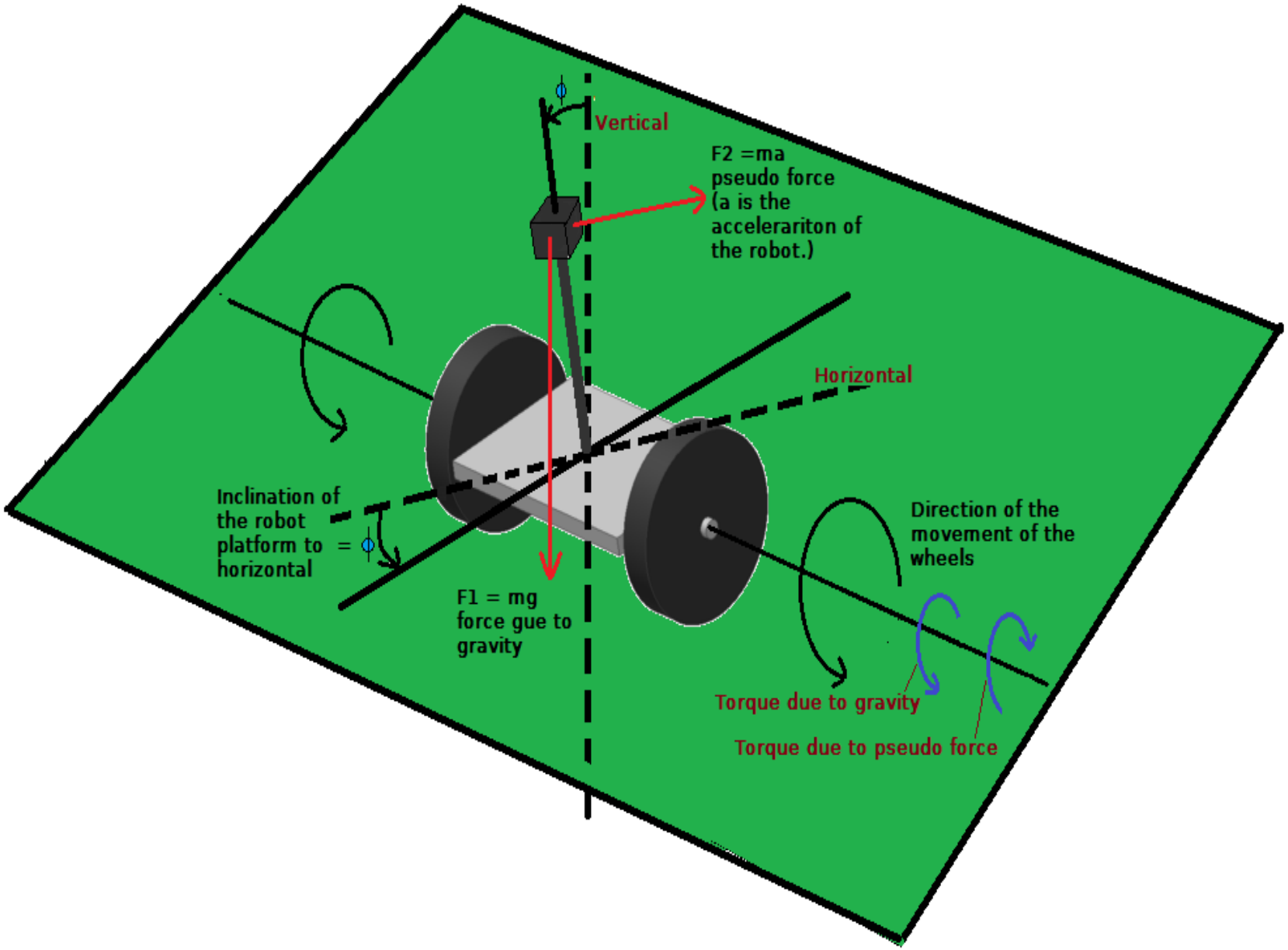
Inverted Pendulum

Technique used in making the self balancing robot is same as the principle used in balancing of the Inverted Pendulum.

Balancing Principle

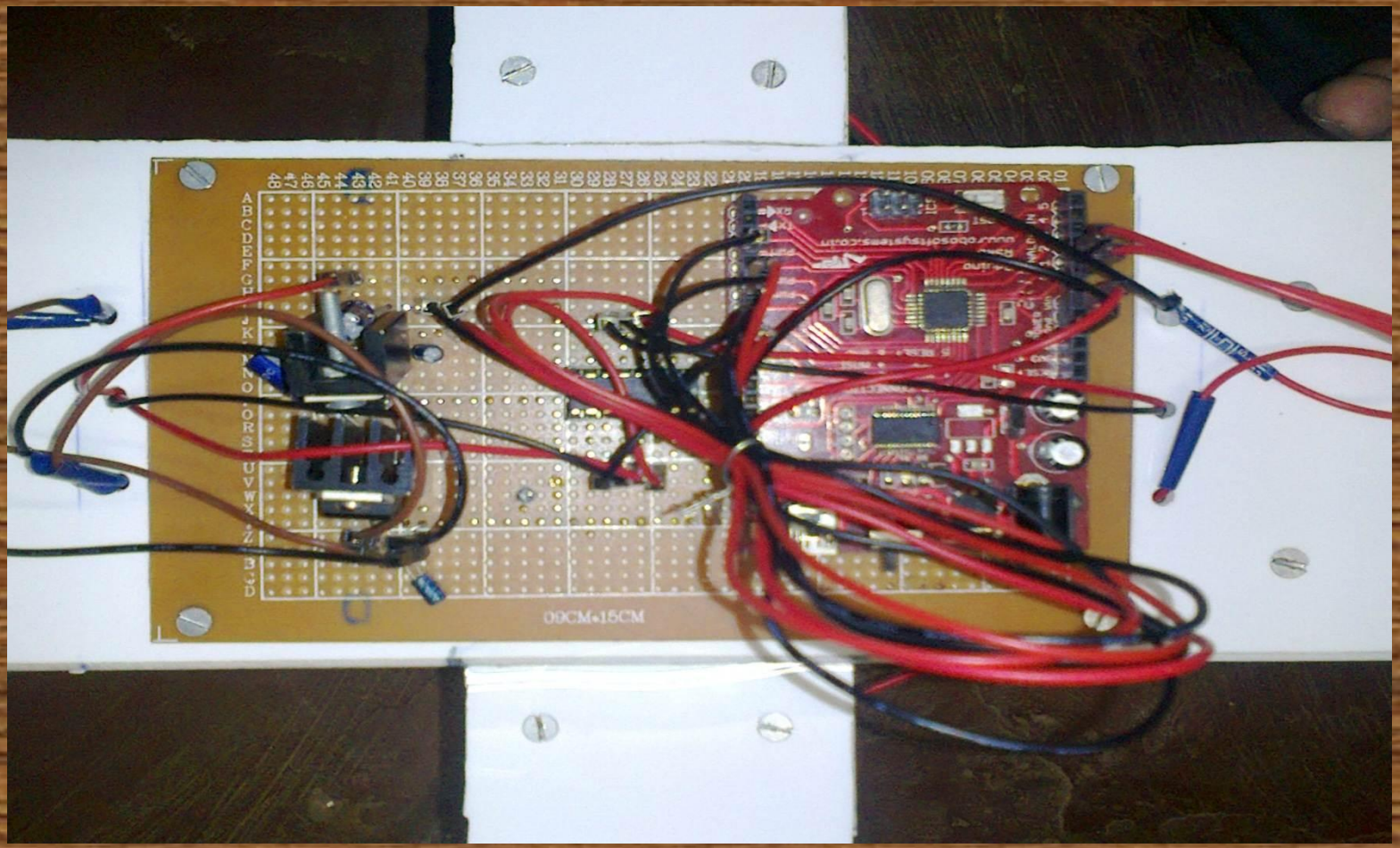
- When the robot starts to fall in one direction, the wheels should move in the falling direction to correct the inclination angle.
- When the deviation from equilibrium is small, wheels should move gently and when the deviation is large wheels should move more quickly.
- It is the acceleration of the robot (not the velocity) that is forcing the robot platform to go to the horizontal level again .

- As soon as the robot accelerates in a particular direction we can find that the torque due to the pseudo force in the non-inertial frame of accelerating robot opposes the torque due to gravity and if it is high enough (obviously depends on acceleration) it can bring the robot platform back to the horizontal level.

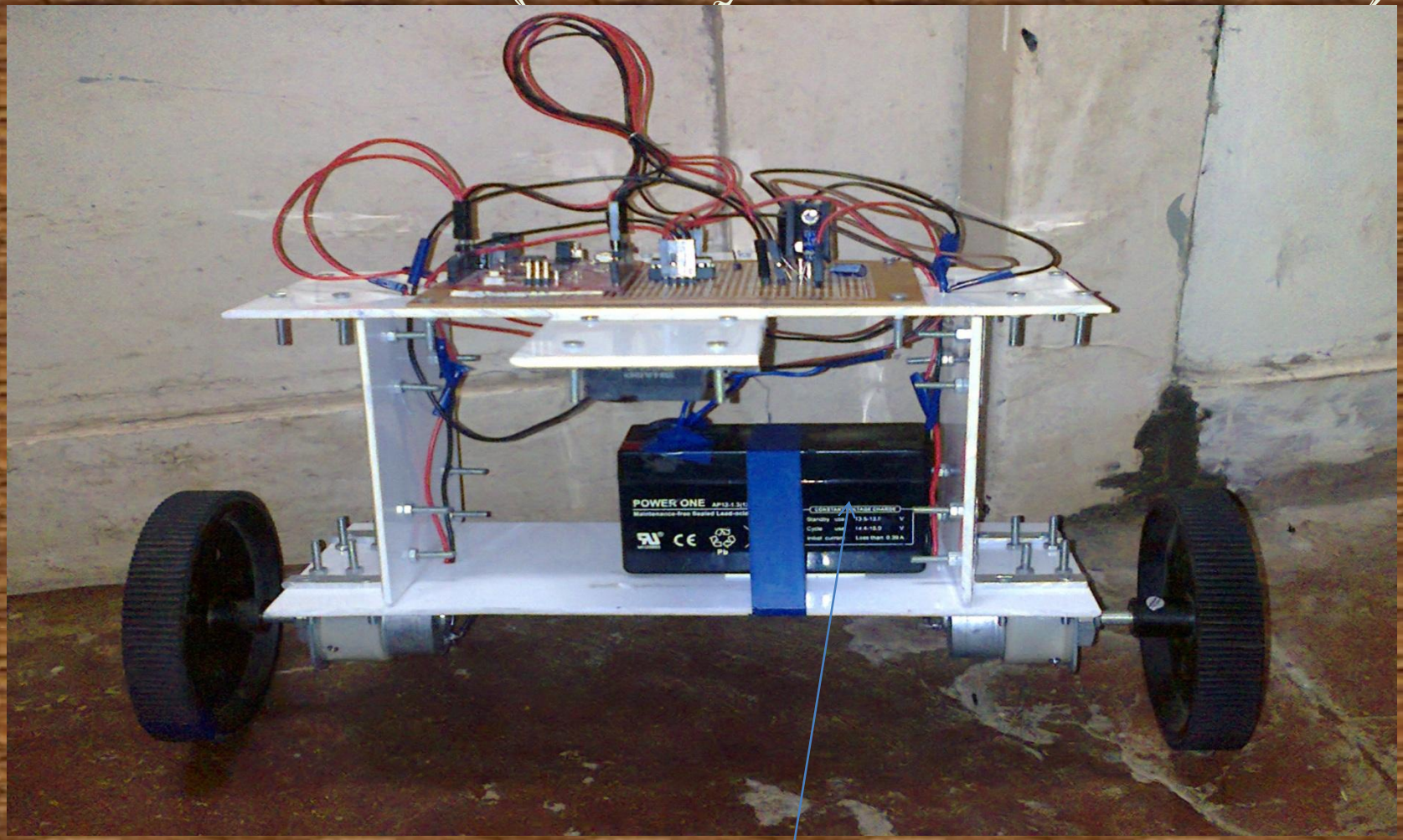

Vertical
F2 =ma
pseudo force
(a is the
accelerariton of
the robot.)
Horizontal
Inclination of
the robot
platform to
horizontal
= ϕ
F1 = mg
force gue to
gravity
Direction of the
movement of the
wheels
Torque due to gravity
Torque due to pseudo force

We made chassis of the robot in the first week.

Working on the electrical level in the second week, we made following motor driver circuit consisting of L293D,IC 7805,7809



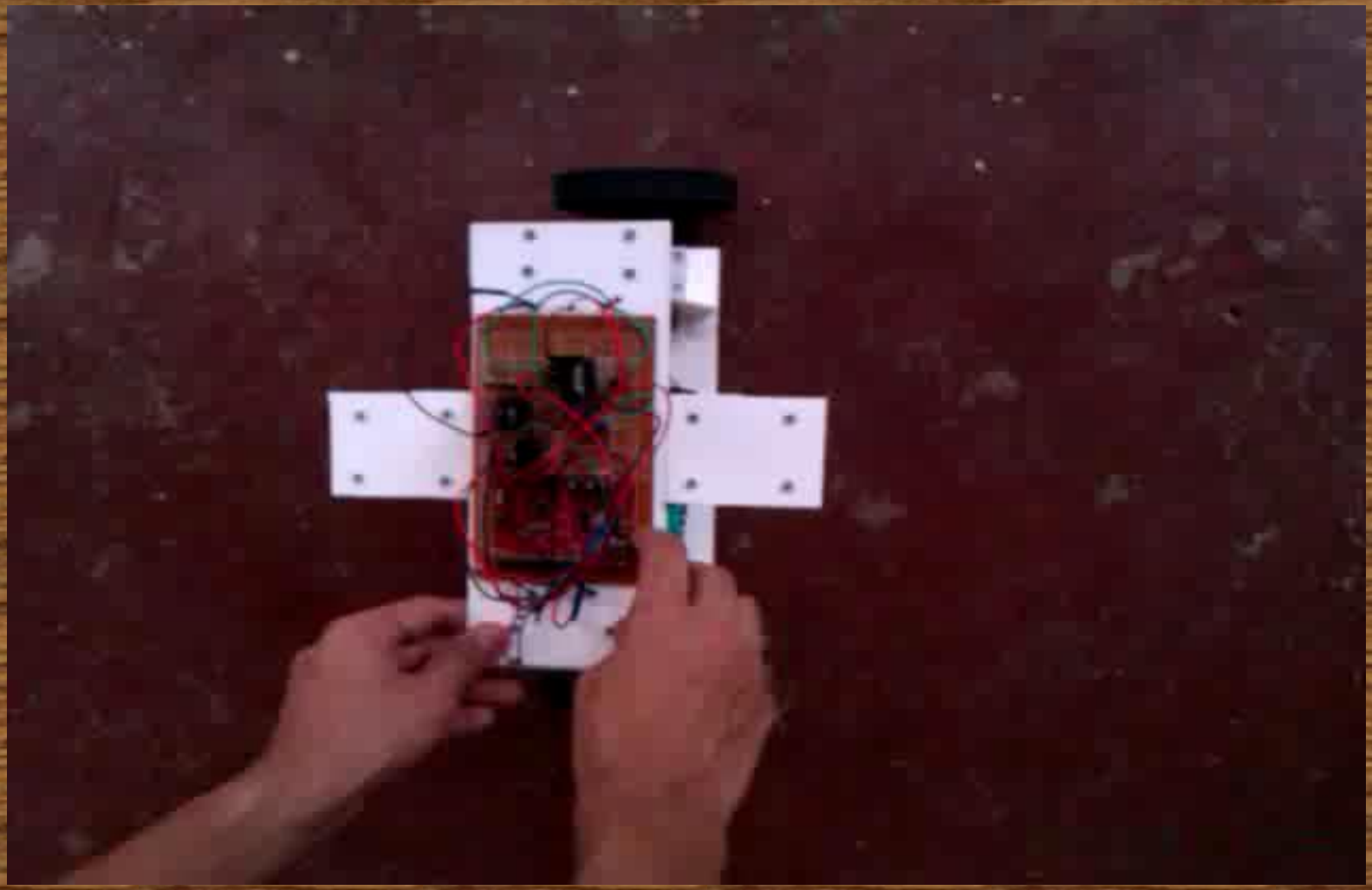
Final robot (ready for calibration)



- Not good to use this battery due to high weight.

New Light Weight Battery (Li ion Battery)

Important part (Calibration)



- The video was of the robot with simple 60 rpm dc motors.
- It failed to get balanced properly.
- Reasons are:

➢ motors do not give fast response

➢ Inadequate acceleration (and so pseudo force)

➢ Center of gravity much above the wheel axle.

What is the soultion?

- To make the response fast we should use fast responce giving motors.
- To increase the acceleration we should increase motors rpm from 60rpm to higher rpm (say 150 rpm)
- We can lower the centre of gravity by shifting the circuit and battery to the bottom. .

- So finally , we need to replace simple 60 rpm dc motors by 150 rpm Johnson Motors giving fairly fast respnce.

Thank You