

The background features a dark blue gradient with faint, glowing star patterns. Overlaid on the left side is a large, semi-circular scale with degree markings from 140 to 260. Several concentric circles and dashed lines with arrows suggest orbital paths or celestial mechanics.

ASTROINSEGUITORE PER FOTOGRAFIA A LUNGA POSA CON ARDUINO E STAMPA 3D

GABRIELE PIANTADOSI

gabriele.piantadosi@gmail.com

ASTROINSEGUITORE

- Strumento di inseguimento della volta celeste
- Permette foto a lunga esposizione → maggiore segnale da oggetti deboli (galassie, nebulose, etc...)
- E' composto solitamente da un unico asse rotante che va allineato con il polo nord celeste
- L'asse principale ruota di moto rotatorio con lo scopo di compensare la rotazione della terra



ASTROINSEGUITORE AUTOCOSTRUITO

- Insieme di:
 - Elettronica
 - Meccanica
 - Stampa 3D
 - Programmazione

PRO

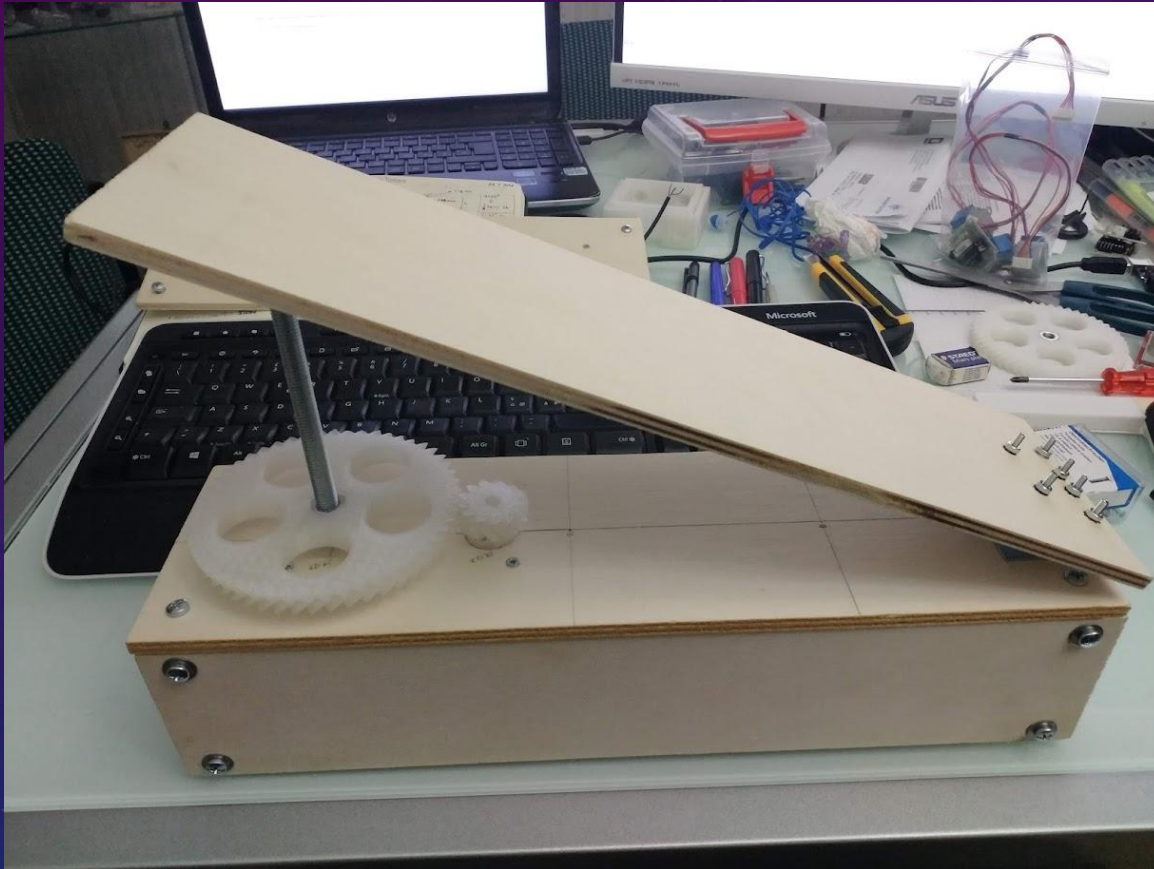
- Economico
- Personalizzabile
- Divertente
- Formativo

CONTRO

- Ingombrante
- Impredicibile

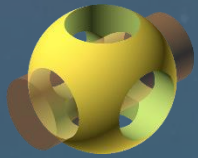


MECCANICA



MECCANICA → STAMPA 3D

Progettazione Meccanica

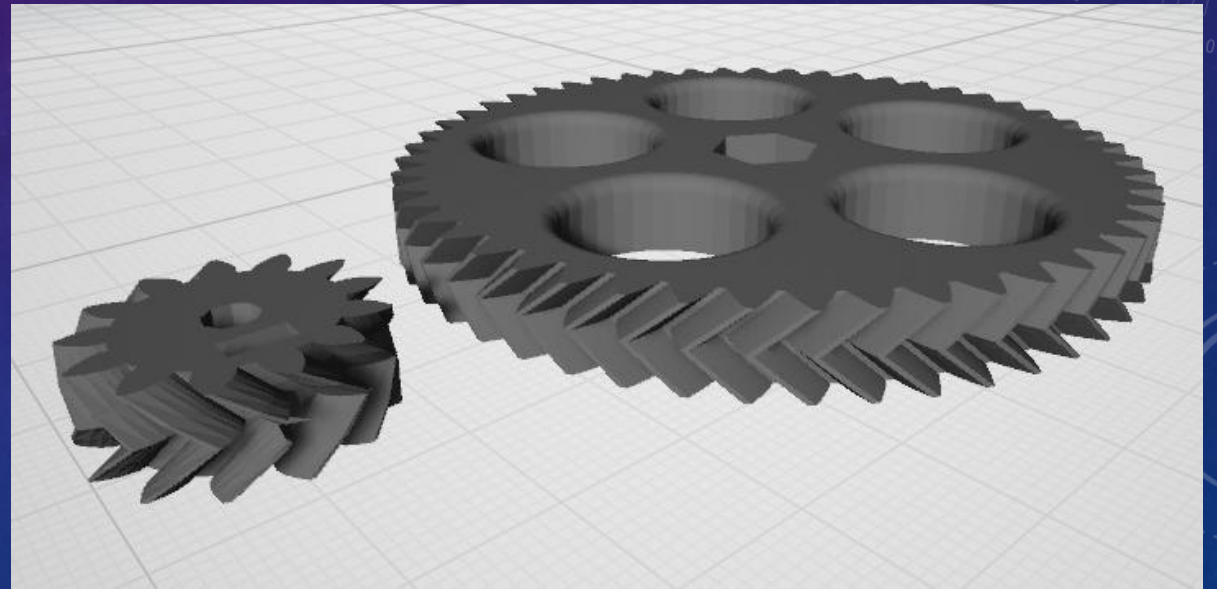
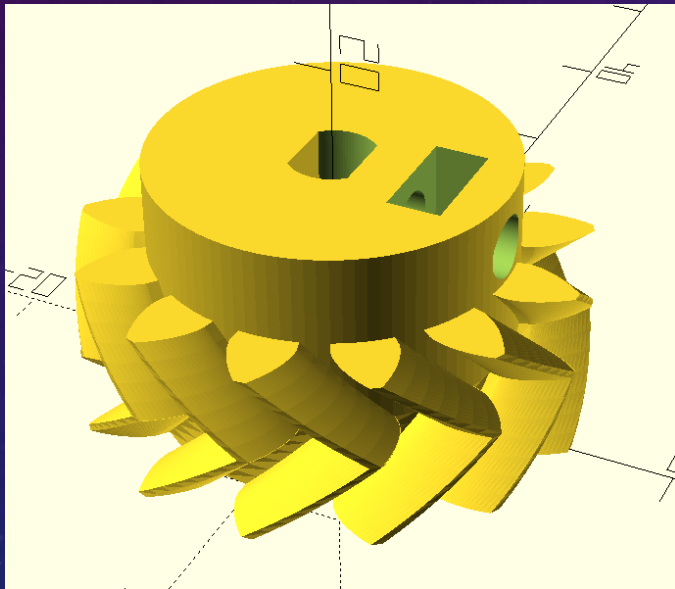


OpenScad

Progettazione Meccanica

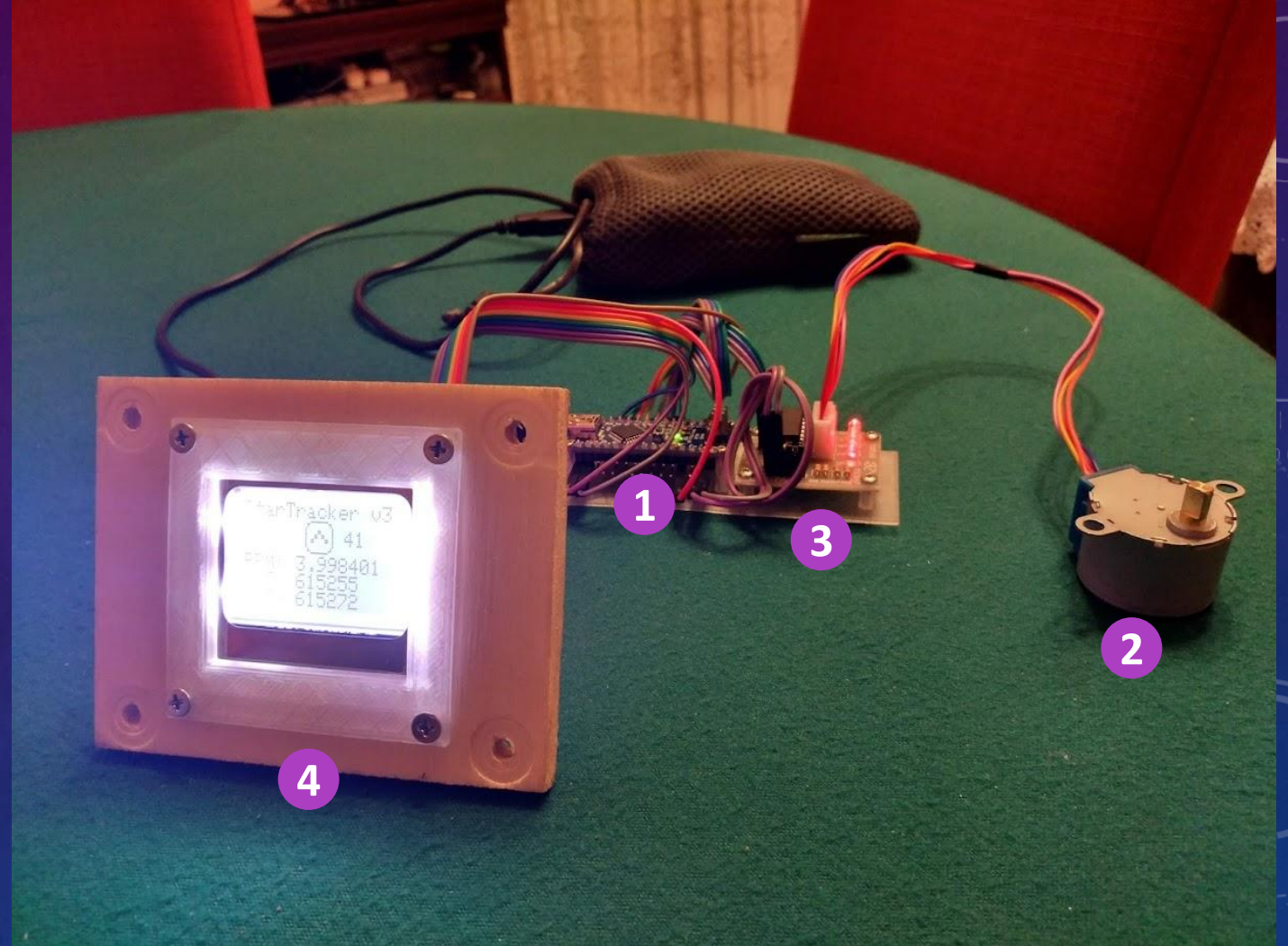


Stampa 3D



ELETRONICA

1. **Arduino Nano**
microcontrollore programmabile
2. **28BYJ-48**
motore passo passo (stepper)
voltaggio: 5V
amperaggio (max): 240mA
internal steps: 32steps/360° → 11.25°/step
motoriduzione: 1/63.68395
outer steps: 2037.8864/360° → 0.18°/step
3. **ULN2003**
Stepper Driver 50V (500mA)
4. **PCD8544**
Nokia 5110 Display 84x48 SPI



PROGRAMMING

```
#include <eRCaGuy_Timer2_Counter.h>
#include <SPI.h>
#include <Adafruit_GFX.h>
#include <Adafruit_PCD8544.h>
```

```
Adafruit_PCD8544 display = Adafruit_PCD8544(10, 9, 8);
```

//STARTRACKER DEFINITIONS

```
#define D (291.2)
#define M8PITCH (1.25)
#define RATIO_R2_X (1/M8PITCH) //R2/X
#define RATIO_R2_R1 (51.0/13.0) //R1/R2
#define TERRA_DT (23.0*60.0 + 56.0 + 4.0/60.0)
#define V_DEG (360.0/TERRA_DT) //DEG/min
#define myTAND_V_DEG (0.01745 * V_DEG - 0.00000005588)
//#define myTAND_V_DEG (0.00437530202906643)
#define V_X (D * myTAND_V_DEG) //mm/min
#define V_R2 (RATIO_R2_X * V_X) //rot/min
#define V_R1 (RATIO_R2_R1 * V_R2) //rot/min
```

//STEPPER DEFINITIONS

```
//#define StepPerRot 4096 //DATASHEET
//#define StepPerRot 4076 //FORUM 2.037,8 * 2 = 4.075,6
#define StepPerRot 4078.0 //MIO
#define CORR 1.01210
#define DEL 60000000.0 / (StepPerRot * V_R1 * CORR)
#define pA 3
#define pB 4
#define pC 5
#define pD 6
```

//STARTRACKER VARIABLES

```
unsigned int nRot = 0;
unsigned long moveStartTime = 0;
unsigned long globalStartTime = 0;
unsigned long timeTook = 0;
unsigned long timeGlobal = 0;
unsigned long timeTotal = 0;
```

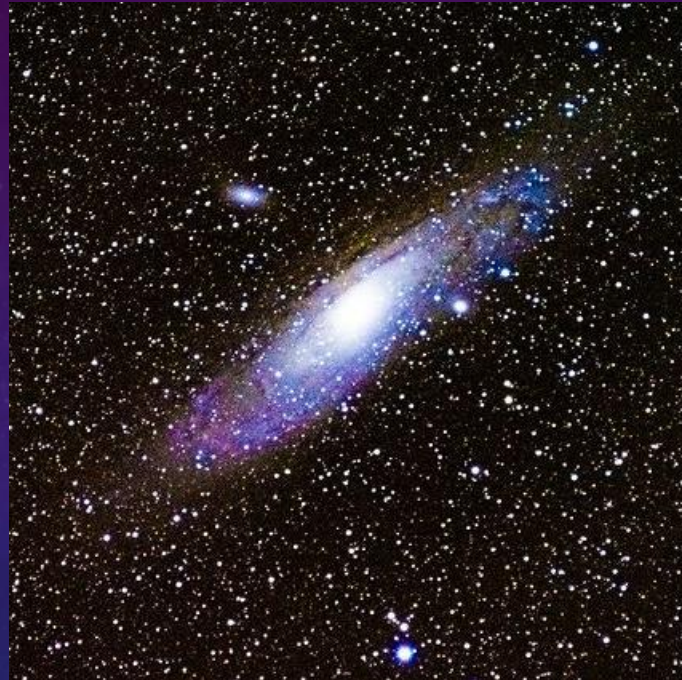
//STEPPER VARIABLES

```
unsigned int nStep = 0;
unsigned int nSeq = 0;
unsigned long lastStepMS = 0;
```

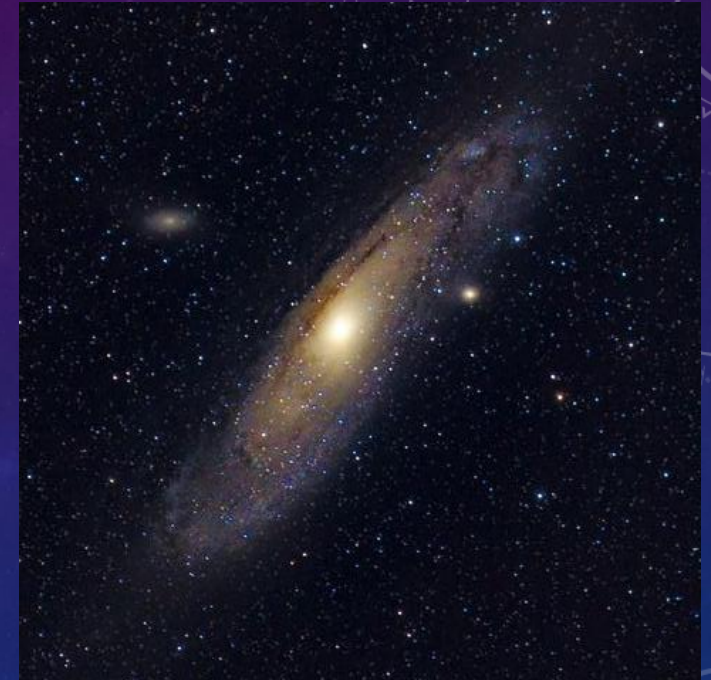
RISULTATI



Camera: Nikon D5600 (DX)
Focal length: 200mm (300mm equivalent)
F-stop: f/5.6
ISO: 800
Exposure: 38x10sec. (6.3min)
Calibration Frames: DARK



Camera: Nikon D5600 (DX)
Focal length: 200mm (300mm equivalent)
F-stop: f/5.6
ISO: 1600
Exposure: 36x30sec. (18min)
Calibration Frames: DARK, BIAS



Camera: Nikon Z6 (FX)
Focal length: 300mm
F-Stop: f/5.6
ISO: 1600+3200+3200
Exposure: 30x30s+25x23s+30x30s (35min)
Calibration Frames: DARK, BIAS, FLAT



THANK YOU

GABRIELE PIANTADOSI

gabriele.piantadosi@gmail.com