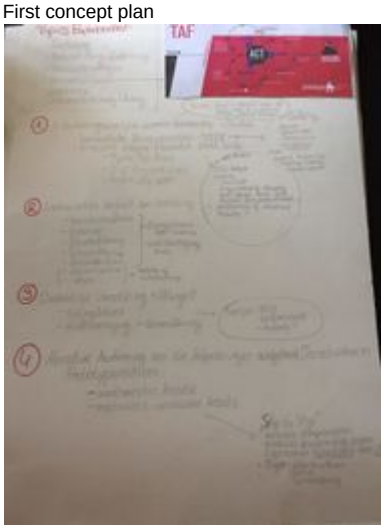
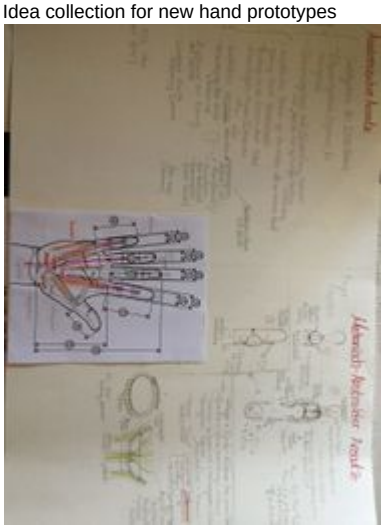
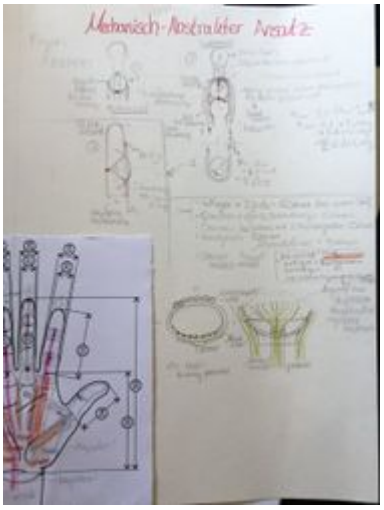
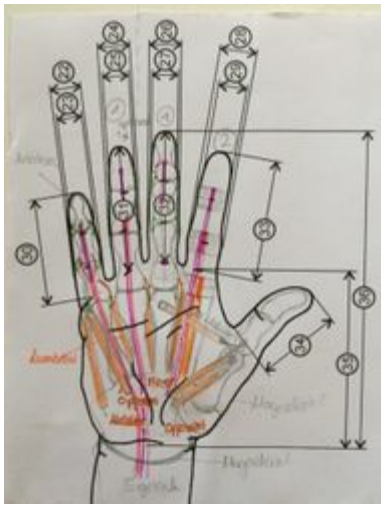
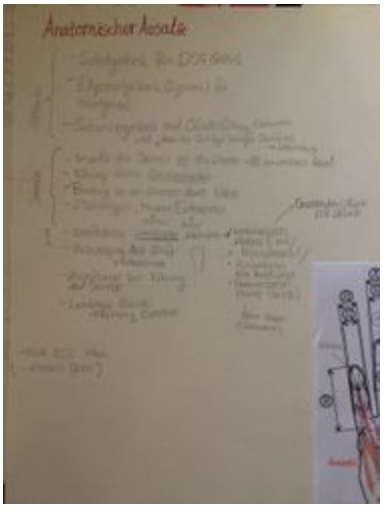
Katharina Hermann - Weekly reports - SATO

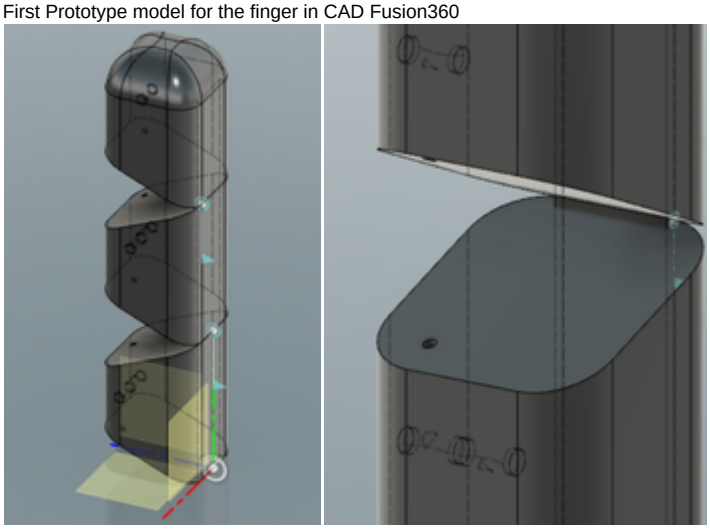
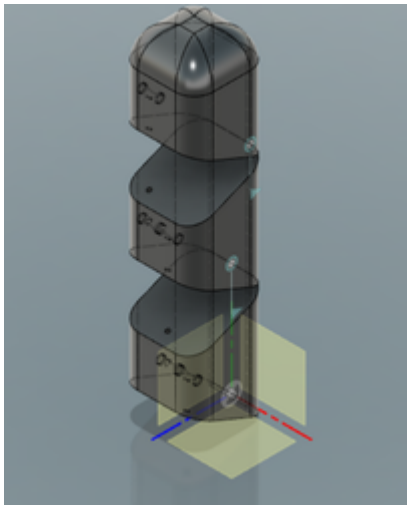
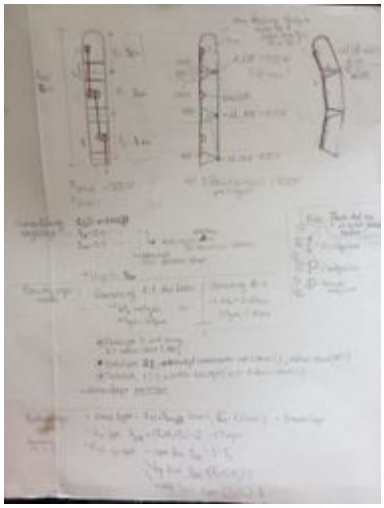
Katharina Hermann

Week	What has been done?	What failed that prevent success?
19.04 - 25.04	-	-
26.04 - 02.05	-	-
03.05 - 09.05	-	-
10.05 - 16.05	-	-
17.05 - 23.05	joined the team	-

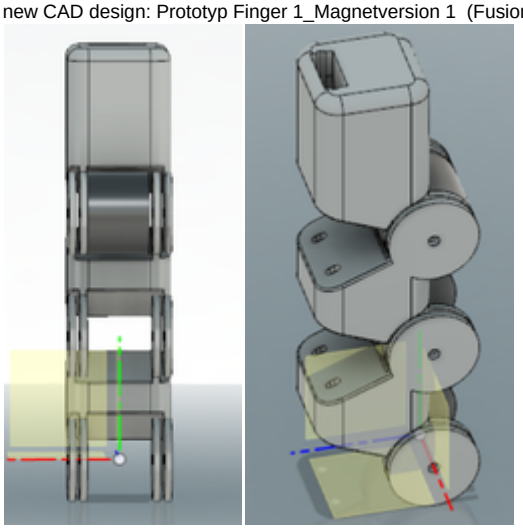
24.05 - 30.05	• Research to understand the mechanism of the human hand • First concept plan   • Idea collection for new hand prototypes   •   • Stronger Hand	• lack of concer presen version hand-a what has be already, did forces etc.? • hard to forces real hu for **any** force a require definiti constra analysi actuall -user s

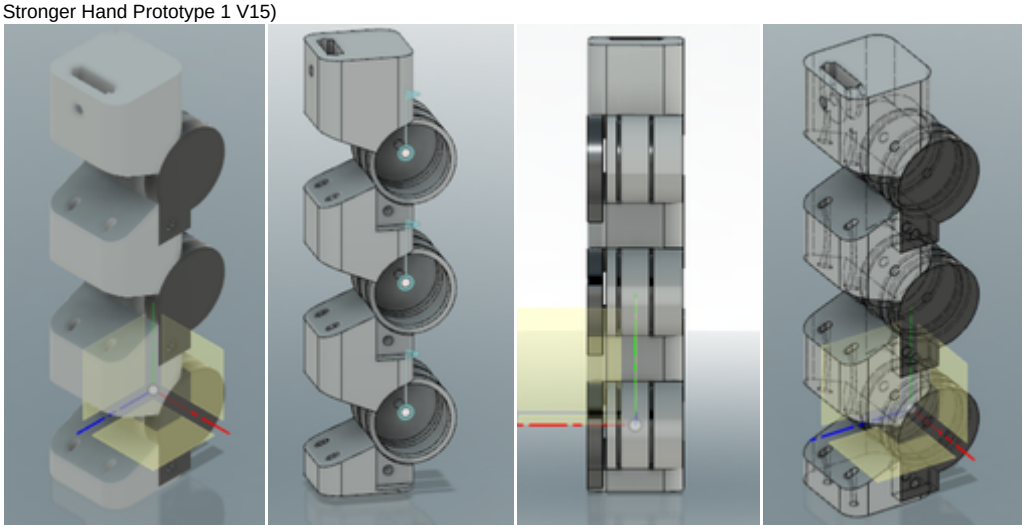
31.05 - 06.06	• Project Plan: Projektplan: • User stories and requirements research interview with Christine Hümmer: no focus on strength requirement (more on movement flexibility and optical similarity to human hands) • concrete goals and requirements definition for the future hand : sources for human hand movements and forces: http://kraftatlas.de/files/kraftatlas/Der_montagespezifische_Kraftatlas.pdf https://edoc.ub.uni-muenchen.de/11100/1/Rickert_Marcus.pdf • CAD introduction by @JürgenLippl • state of the art research: Books selection -sources for thesis	concrete goa requirement not complete missing inte Rafael

07.06 - 13.06	• calculation of forces acting within the finger system of a hand for the most general case of grisping
	• interview with Rafael-definition and clarification of requirements for the strong hand: Requirements.docx
	  • focus on functional hand: maximization of forces and precision for grasping - approximation to human hand forces vision: carrying 90kg
	  • motors for the hand: 4x Myobrics for "strong forces" + Dynamixel for "weak forces"
	  • optical approximation to human hands neglected
	  • functional realization of range of motion and DOF (for grasping), other motions neglected
	  • no studies of the old hand (other requirements were assumed)
	  • inspiration from state of the art:
	  https://softroboticstoolkit.com/about
	  Towards_a_bio-inspired_leg_design_for_high-speed_running.pdf
		calculation c
		transmitted f
		cases not po
		
		own calculat
		prototype de
		each graspi

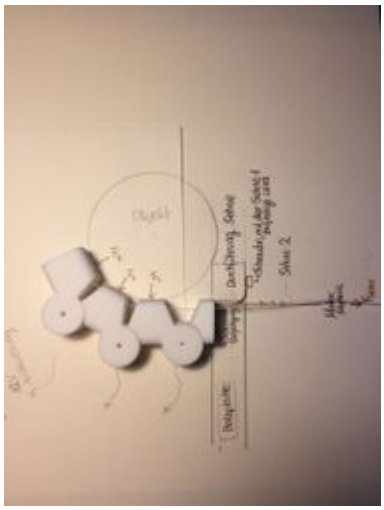
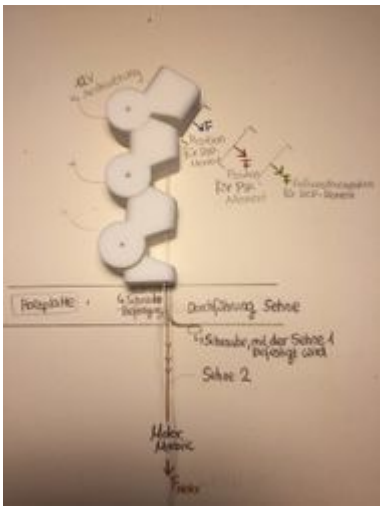
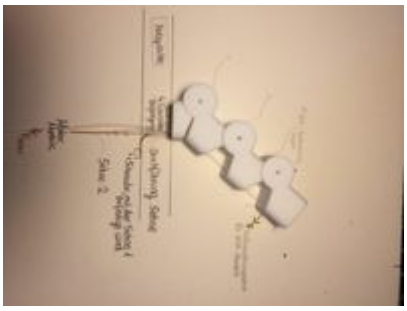
14.06-20.06	Thesis • research documentation in Zotero • Set the goals, • wrote the Abstract • worked on the structure for the thesis Practical part: Prototyping • First Prototype model for the finger in CAD Fusion360 •  •  • 	• would r feedba prototy the righ

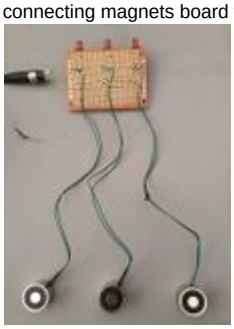
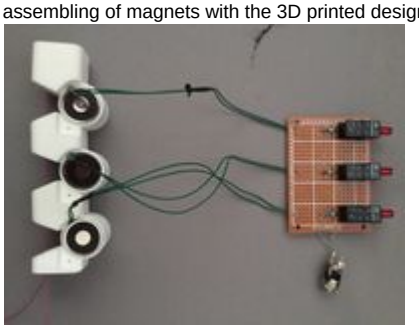
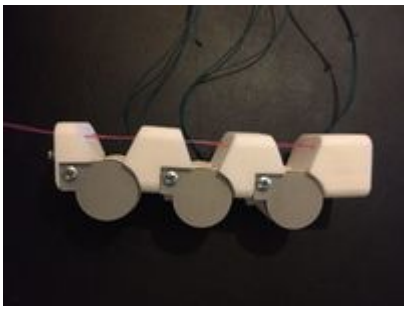
20.06-27.06	meeting with Rafael, Darwin and Jürgen:
	
	• discussion of the first design prototype propose
	• brainstorming on new design approaches with the given requirements
	• conclusion:
	  ◦ focus on force maximization- 300N Myobric at least for the closing of the hand
	  ◦ new design with with only one tendon routing around all fingers
	  ◦ variation of range of movement realized not by actuating different tendons, but via electro magnets control
	  ◦ no mechanical parts within the finger/ hand
	
	research on suitable electro magnets to implement on the hand:
	
	• need to be small, strong enough, and not too expensive!
	
	research on biomimetic and other hand solutions:
	
	• analyzation matrix to extract design advantages and aspects of existing hands
	  ◦ Matrixanalyse des Stands der Technik.docx
	• first selection of several robotic hands to analyze :
	  ◦ i-HY Hand
	  ◦ SDM -Hand
	  ◦ High Speed Hand (Namiki et al.)
	  ◦ Barrett Hand (Townsend)
	  ◦ DLR-Hand (Butterfass et al.)
	  ◦ Cyberhand(Carrozza et al)
	  ◦ Unipi-Hand (Catalano et Al.)
	  ◦ Columbia Hand
	  ◦ Prosthetic Robot Hand with High Performances Based on Novel Actuation Principles
	  ◦ Uthah/MIT Dextrous Hand(Jacobsen)
		• further
		prototy
		whole
		not ma
		long as
		not tes
		prototy
		compo
		by step
		
		(Finger Inte
		fingers Palm
		of fingers on
		Interaction
		hand)
		
		• Studyir

28.06-05.07	• studying for exams
	• overview for the architecture - big picture
	• kinematic analysis:Kinematikanalyse und resultierende Anforderungen an das Handdesign.docx
	• new CAD design: Prototyp Finger 1_Magnetversion 1 (Fusion location: Master Stronger Hand Prototype 1 V15)
	 
	•
	• found several electro magnets for the new design:
	  ▪ https://www.amazon.de/dp/B07D5VNQ2J/ref=pe_386171_37038121_TE_psd_dp_2
	  ▪ kleiner aber immer noch sehr groß ⊖, weniger Kraft ⊖, günstiger ⊕
	  ▪ https://www.maqna.de/elektromagnete/permanentmagnete-bei-stromabschaltbar/permanentmagnet-20x22mm-haftkraft-40n/a-2359/
	  ▪ größer ⊖, mehr Kraft ⊕, teurer ⊖
		• studyin
		• probler

06.07-12.07	• studying for exams
	• Improvement and redesign of CAD model to make it printable: Prototyp Finger 1_Magnetversion 2 (Fusion location: Master Stronger Hand Prototype 1 V15)
	 
	• Ordered the components for Prototype 1 - Finger
	  • Magnet (https://www.amazon.de/dp/B07D5VNQ2J/ref=pe_386171_37038121_TE_psd_dp_2)
	  • Umlenkspule (https://www.amazon.de/gp/product/B072TT78S6/ref=oh_aui_detailpage_o01_s00?ie=UTF8&psc=1))
	• Ordered the 3D printed part at Shapeways
	• Started
	  • design report: "Why did I build the prototype like this?"
		• studyin
		• several details model be imp actuall work

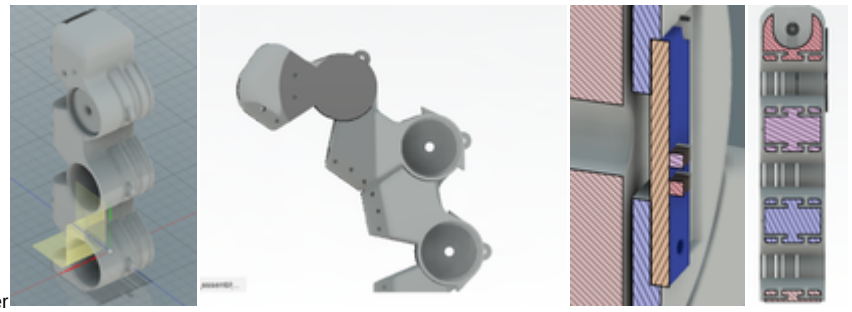
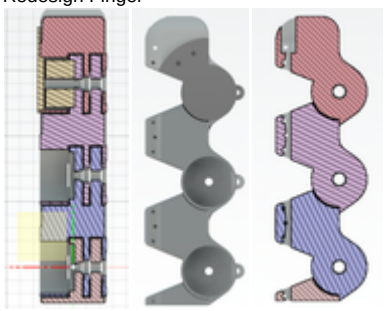
13.07-19.07	• Worked on
	  • design report: "Why did I build the prototype like this?"
	  • Prototyp 1-Dokumentation.docx
	  • detailed pictures for description missing
		• Only th has be so far,
		
		no a possi
		
		Magr delive end c begir Augu
		
		• Studyir

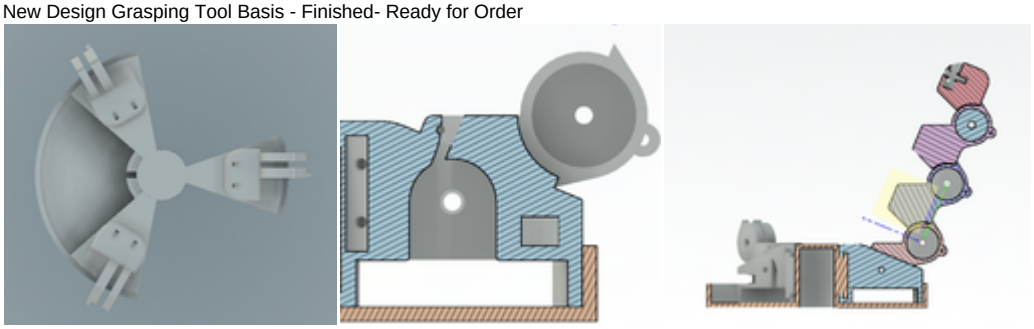
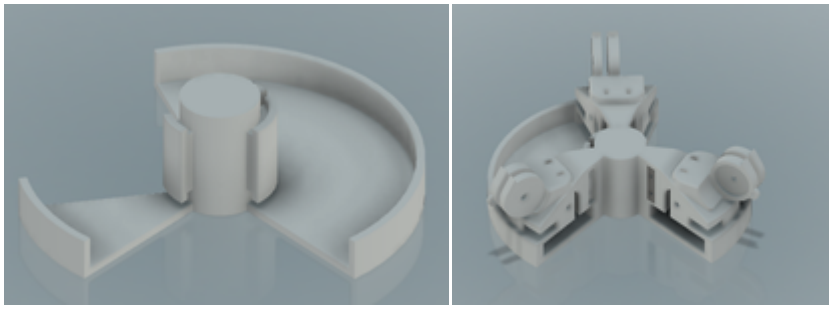
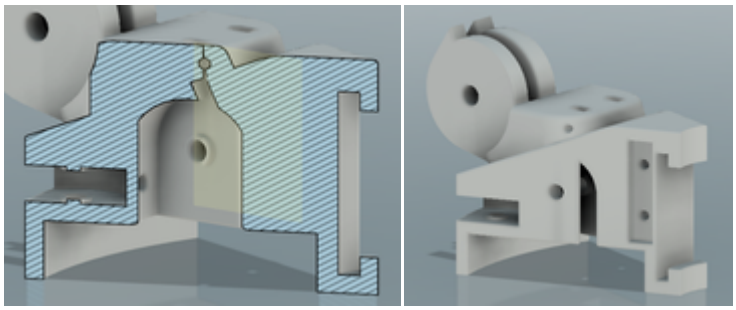
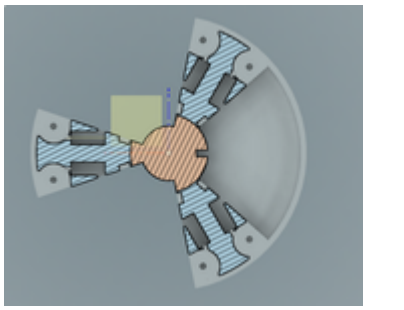
20.07-26.07	• Finished Design report "Why did I build the prototype like this?"
	  • Included part: Testing for Verification and Validation
	  • Prototyp 1-Dokumentation mit Testing.docx
	
	Drafting of test stand for finger prototype
	
	 
	 
	
	 
	 
	• Constructed complementary part for magnet
	Plan Magnetstück.pdf
		• Studyir
		• Only th and the pulley I deliver
		
		no a possi
		
		no re possi

27.07-02.08	• Assembling of the prototype:
	  • connecting magnets board with 3 switches to control each magnet separately
	  
	  • assembling of magnets with the 3D printed design
	  
	  • attachment of the counter-part for the magnet
	  
	  • first test for magnets and control mechanism went well, friction yet to low without roughening to transfer a strong moment, but works already pretty good
	    
		• studyin
		
		still things le assembling
		
		• roughe counte magne
		• attachr elastic "backw movem
		• attache return

03.08-09.08.	finished assembling of the prototype	studying for

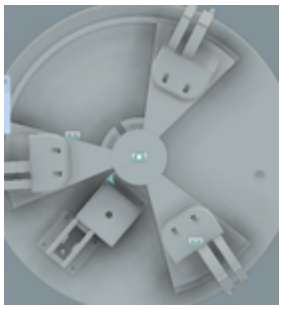
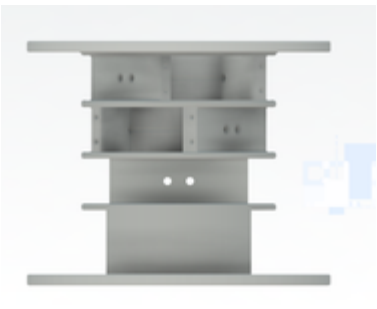
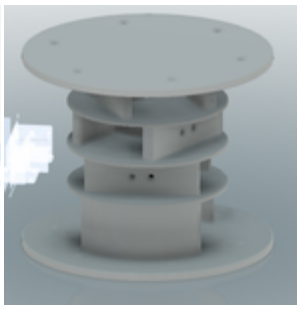
10.08-17.08	• Tested and Validated the Prototype roboytest.mp4 •  • **Changed the overall Goal for the Thesis from the whole hand on the finger with the magnets mechanism** • Prepared the Final Video • Prepared the Final presentation • https://docs.google.com/presentation/d/1_0nE4tMia4z22hZ954lxIGciPb_UkKacTg8pgGlyPXs/edit#slide=id.g3ec80edb3f_0_24	
18.08-23.08	Rearranged the Structure of the thesis: TOC: Inhaltsverzeichnis.docx Finished Behavior Modell- Kinetikanalysis:	New Change Plan: Design of • Genera for Gra Undera • Prototy Seperatley

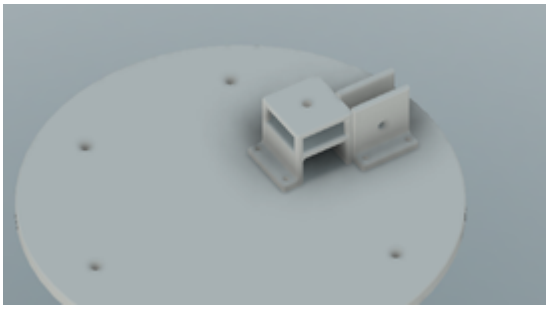
24.08-30.08	Design of the Second Prototype: • Redesign Finger  • New Design Grasping Tool Basis  First draft for the test bench on CAD • got normal Servo Motors from Andi from Utum	didn't place shape ways the Graspin is way too e
31.08-06.09	Design of the Second Prototype:	could not wo the first 3 da week online maintenanc

- New Design Grasping Tool Basis - Finished- Ready for Order
  
  
  
  

Design of the Test Bench:

- Finished CAD-Model - Ready for Order



- Created BOM-Maintenance Document for:
  - Prototype2
  - Test Bench
  - BOM-Maintenance.xlsx

- Wrote first draft of Documentation for Prototype 2 (only text):

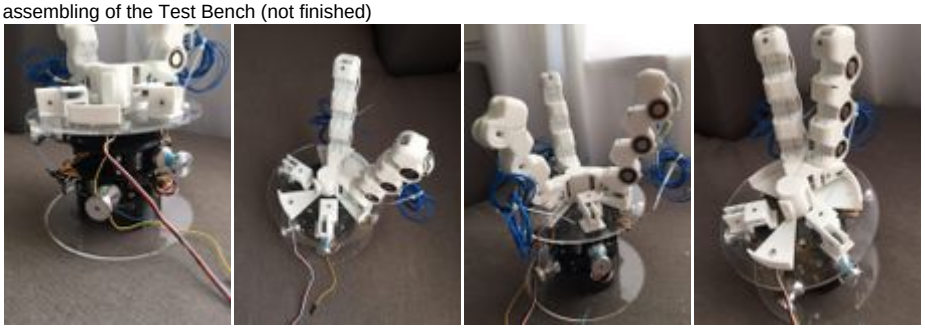
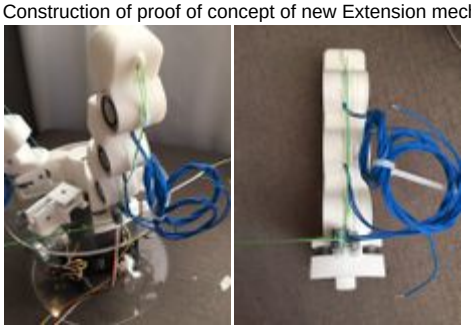
  Zweiter Prototyp.docx

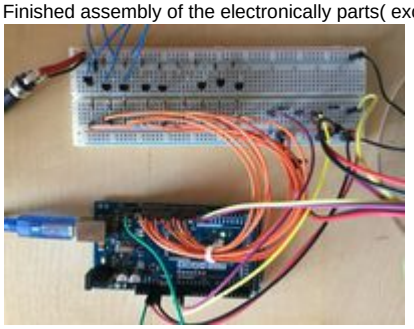
- First ControlLogik Diagramm for the Tests
- 

- Started Dokumentation of the Test Bench
  - Zweiter Prototyp.docx (Update)

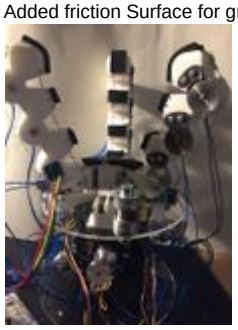
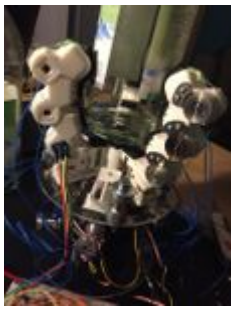
07.09-13.09	• ArduinoProgramming Part for the Test Bench:
	  • Set up for the Electronic Hardware for the Arduino Microcontroller:
	  • Designed Circuit for Magnet Control
	  • Connected the Servos for test run
	  • Connected one PCB Board for Magnet Sensing (trial)
	  • set up Object oriented structure for software programming
	  • ClassDiagramm.pdf
	• Research for Final Motors:
	  • Motorauswahl.xlsx
	• Order of new Servo Motors for Test Bench
	  • Adafruit Feedback Servos: https://www.adafruit.com/product/3614
	• Meeting with Anand Suresh : (1h)
	  • discussed a way for contact detection (and force measurement) : Spring arrangement with hall sensors (Motor force measurement for feedback control)
	  • Test Bench: waiting for Servo Motors to arrive to go ahead with: (**TO DO** design motors in Fusion)
	  • Lasercut the plates with new material: Delrin (**TO DO** order at UTum)
	  • 3D print the other parts of the embodiment
	  • talked about the programming part (discussed the Class Diagramm) no controlling with path planning inverse kinematics but just forward kinematics control (predefined grasping motion for 6 different types of grasping)
	• Looked for ways to Realice Spring Arrangement for Tendon Force Measurement:
	  • Potentiometer (Slider) for displacement measurement of the Spring https://www.exp-tech.de/sensoren/sonstige/4652/slide-pot-small-10k-linear-taper
	  • Spring Force has to be within a range of ideally (0N up to 44N) for the Servos, but more for the final version with Maxon Motors.
	  • nonlinear progression characteristic of Springs only available for Cone Springs, (but hard to find)
	• Update for the Test Bench Dokumentation+ Update of CAD Model :
	  • Test Bench_Evaluierung des Greifers.docx
	• Finished final Order for all Parts of the Second Prototype
	  • Anzugsplatte
	  • Capstan
	  • Screws
	  • Magnets
	• waiting for parts to arrive...
		Couldn't prir
		bench, since
		information f
		dimensions
		feedback se
		missing
		(servoswere
		arrive earlie

14.09-20.09	No Progress	Mandatory Scholarship
21.09-27.09	No Progress	Mandatory S School

28.09-04.10	• assembling of the Gripper (not finished) • assembling of the Test Bench (not finished) •  •  • Wrote main-functions for Tests in Arduino https://github.com/Roboy/Stronger-Hans-/blob/Programming-Part-for-Tests/Test_Main.ino • Construction of proof of concept of new Extension mechanism with konstant Force, instead of Spring arrangement • 	• PCB B ready assem • Force constr assem since F Spring there • Anzug for Co plate f Elektro were n yet

05.10-11.10	• Basic Modeling of Kinematics in Matlab • Research+ Writing Kinematics _Modelling part of the Thesis • updated BOM-Maintenance File BOM-Maintenance _Final Version 08.10.2018.xlsx Fixed remaining Mechanical assembly of the test bench: Mechanical part of the prototype finished now • Mounting of constant spring Construction: • Mounting of the Counterpart plate for ElektroMagnets  • other smaller fixes  Finished assembly of the electronically parts(except for the missing PCB boards)  • new version of the code for the tests (Test main) • https://github.com/Roboy/Stronger-Hand	• PCB B missing • (all fun control depend them)

12.10-18.10	• first steps of finally actuating the finger with the board (without missing PCB boards)
	  • not possible to actuate it and control the position it by the Motor angle since the values are very unprecise (alternative solution instead of the BCB boards)
	• only remaining possible ways to actuate it:
	  • by time
	  • by manual STOP and GO via the Monitor
	
	IMG_2018...2:39.mp4
	
	• new version of the code for actuating the fingers (libraries)
	  • https://github.com/Roboy/Stronger-Hand
	• continued writing for the thesis
		PCB boards

19.10-25.10	• managed to get 2 PCB boards can do tests at least for to Joints
	• Prepared everything for the Tests
	  • Tested Funktions for Tests and changed them for manual control due to the missing PCB Boards
	  • Saving data to CSV files with TeraTerm
	• Added friction Surface for grasping:
	 
	• Tested first "Underactuated" Grasps:
	   
	• Finished tests for Kinematik
	  • tested set of about 60 objects within the "FFP Index" test
	• Finished tests for Force-- > max 7kg in the best case
	• Finished other tests from the testset
		• 2 Magr
		  • ne
		  fo
		• 3rd PC
		  workin
		  • ca
		  th
		  fir

26.10-01.11	• Writing thesis	
02.11-08.11	• Writing thesis	
09.11-15.11	• Writing thesis	
16.11-22.11	• Writing thesis	
23.11-29.11	• Writing thesis	
30.11-06.12	• Writing thesis	
07.12-13.12		
14.12-20.12		