# Development of a Five Axis Robot Arm implemented using a PIC Microcontroller and LabVIEW Robotics 2010

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Ayush Dewan
Saurav Gusain
Souri Guha
Applied Electronics and Instrumentation
2011 Batch

# Our Objective

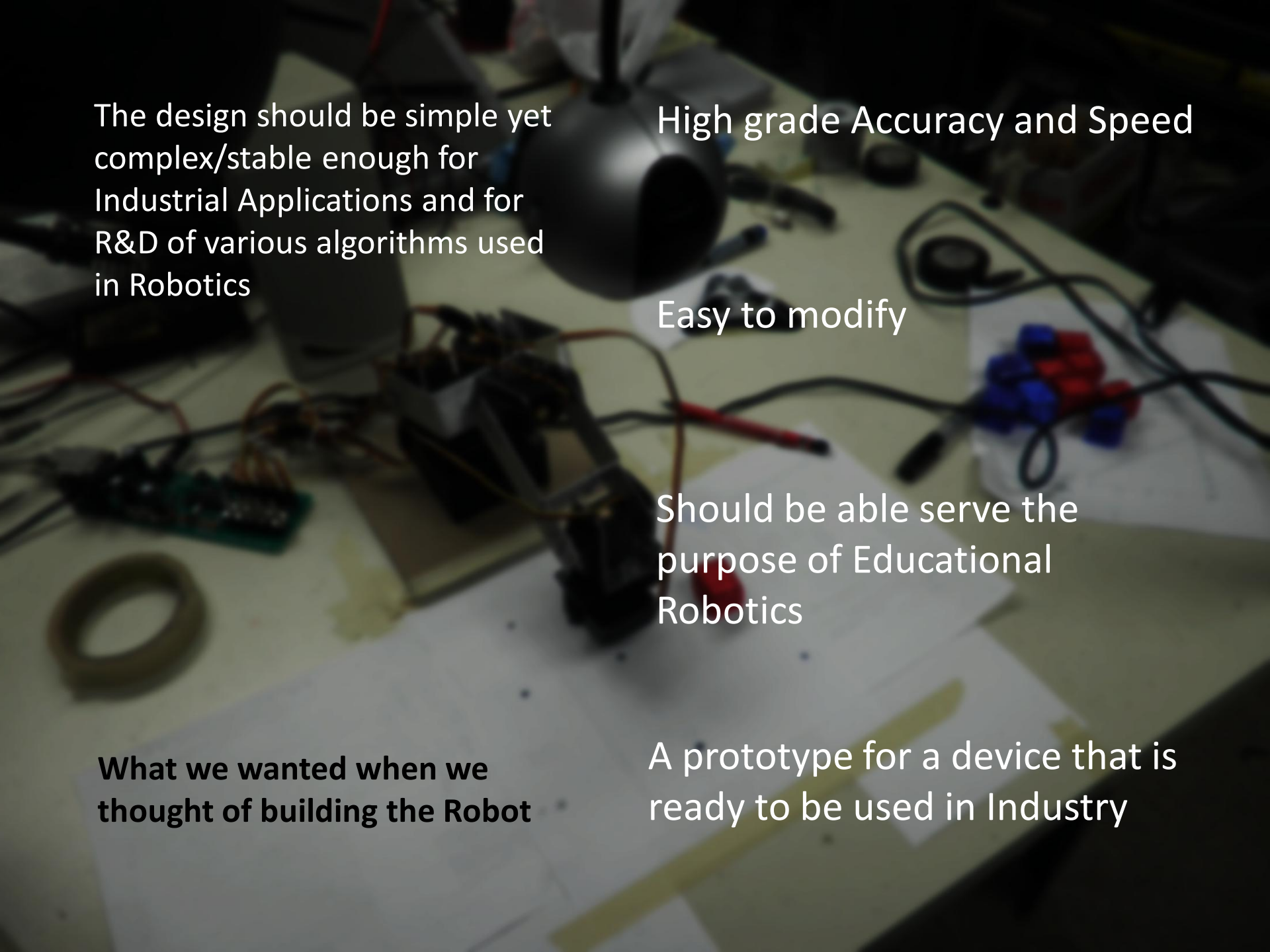
Our aim is to build a *4-axis Robot Arm*

The motion of the Arm will be controlled by a PIC Microcontroller that will communicate on a real time basis with LabVIEW which will do the calculations

The basic function of the device will be to pick and place small objects

# Agenda

- Concept & Motivation
- What we wanted
  - The big picture
- Visualization
- Distribution of Work
- Mechanical Design
  - Resources and help
  - Design stages
- Logic Overview
  - It’s all about building an intelligent device!
- Electronic Design
  - Components we needed
  - Getting them to talk to each other
  - Development of the PCB
- Programming the Brains of the Robot
  - Why LabVIEW?
  - Interfacing PIC with LabVIEW
  - Moving the first Motor
- Remaining Work
- Project Budget
- ETA
- Resources



The design should be simple yet complex/stable enough for Industrial Applications and for R&D of various algorithms used in Robotics

High grade Accuracy and Speed

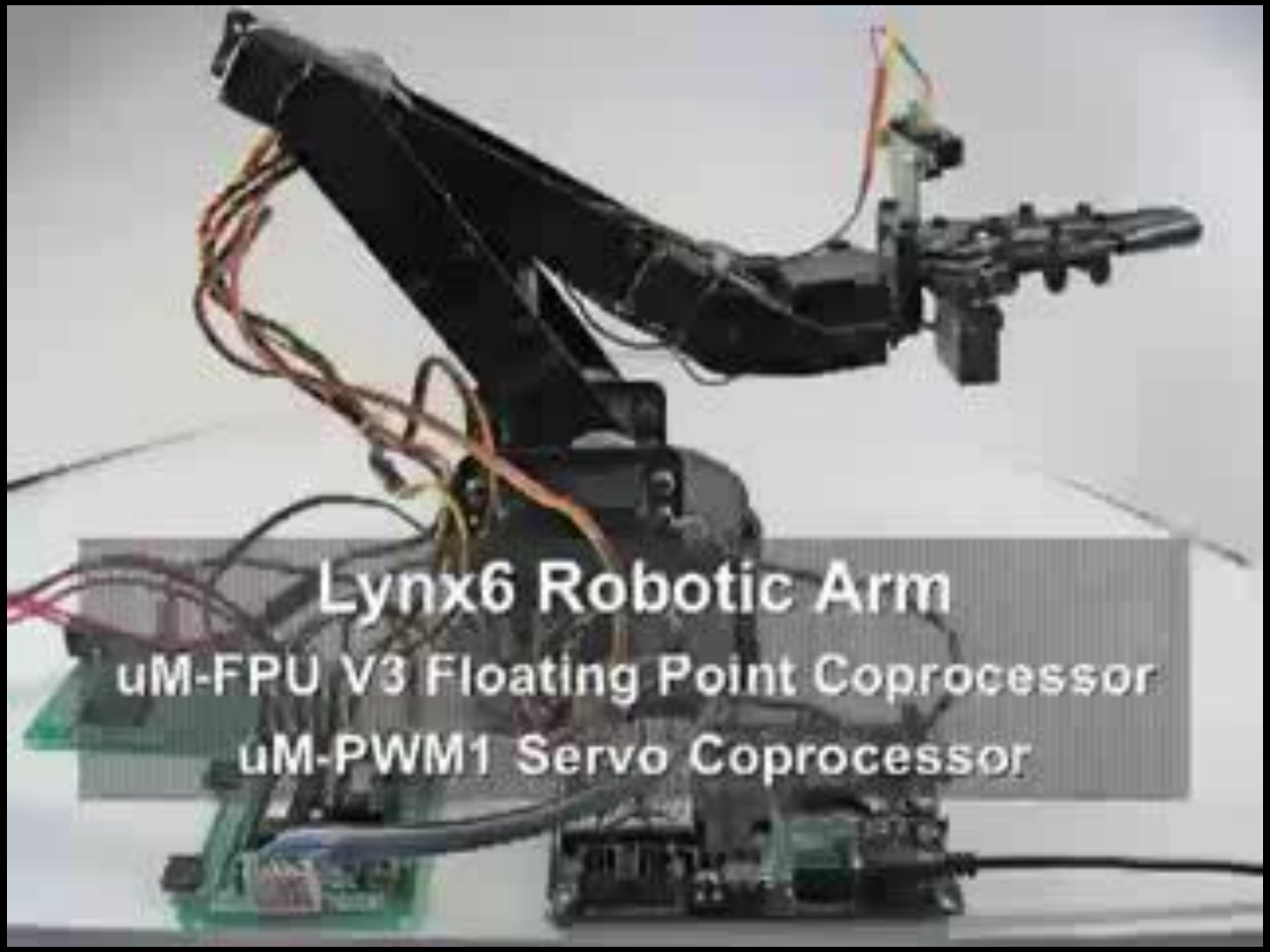
Easy to modify

Should be able serve the purpose of Educational Robotics

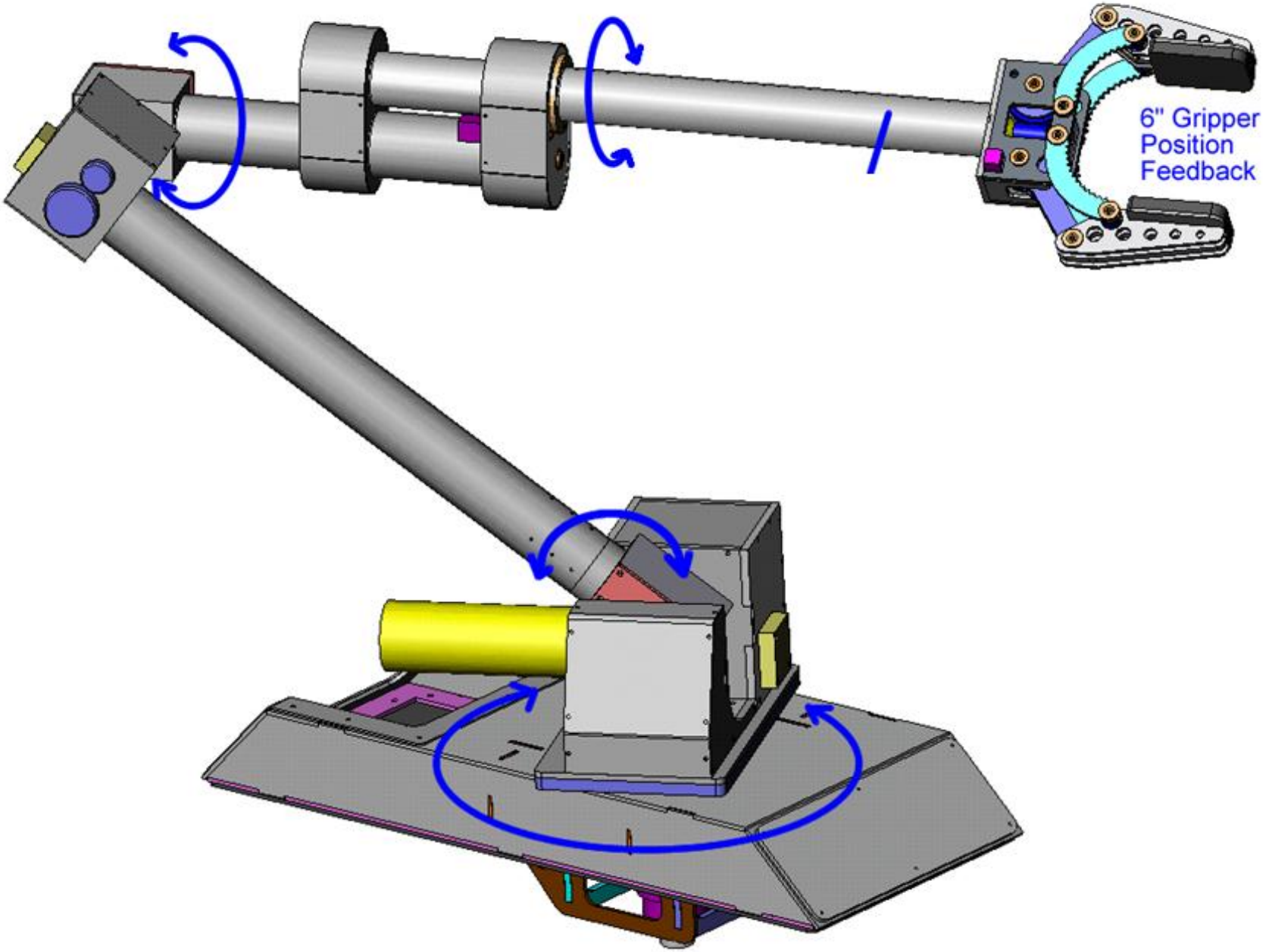
**What we wanted when we thought of building the Robot**

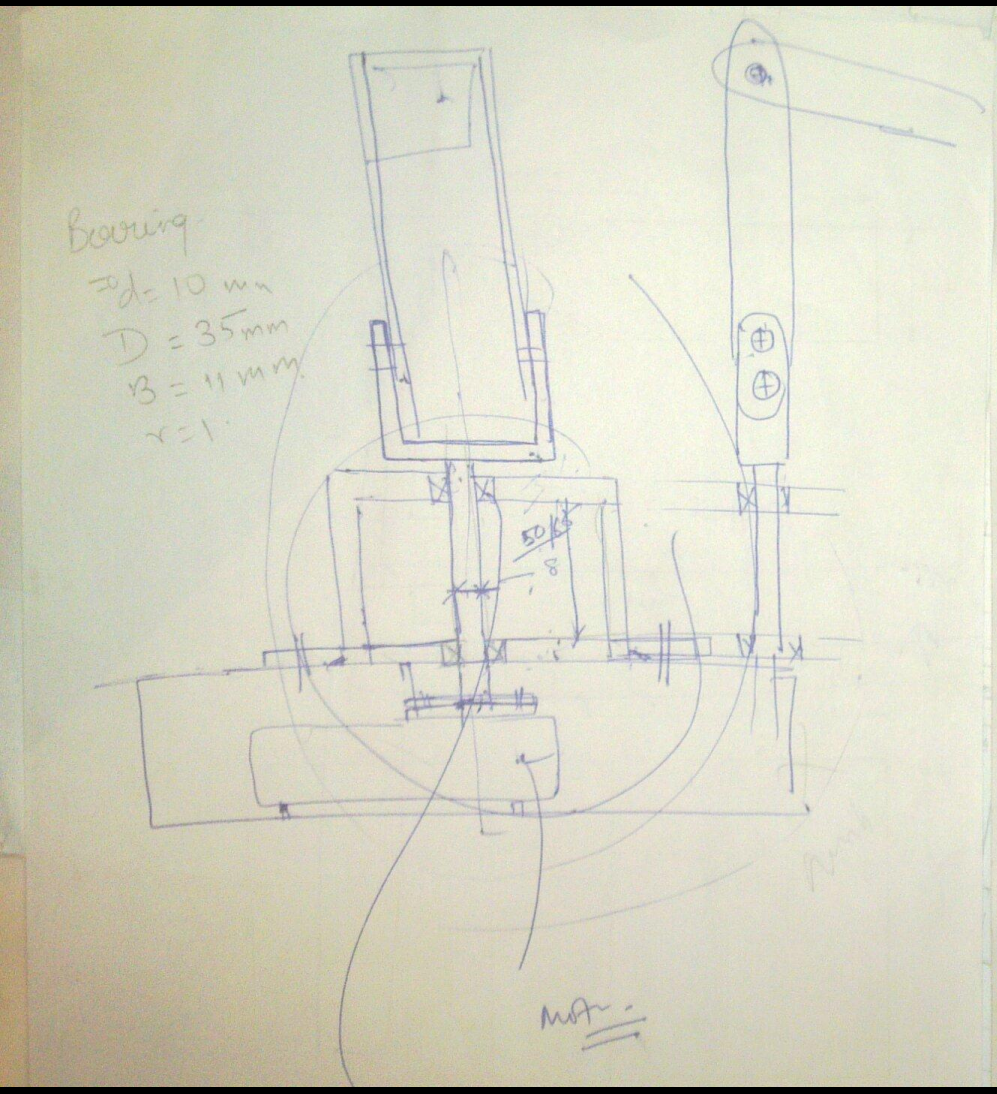
A prototype for a device that is ready to be used in Industry

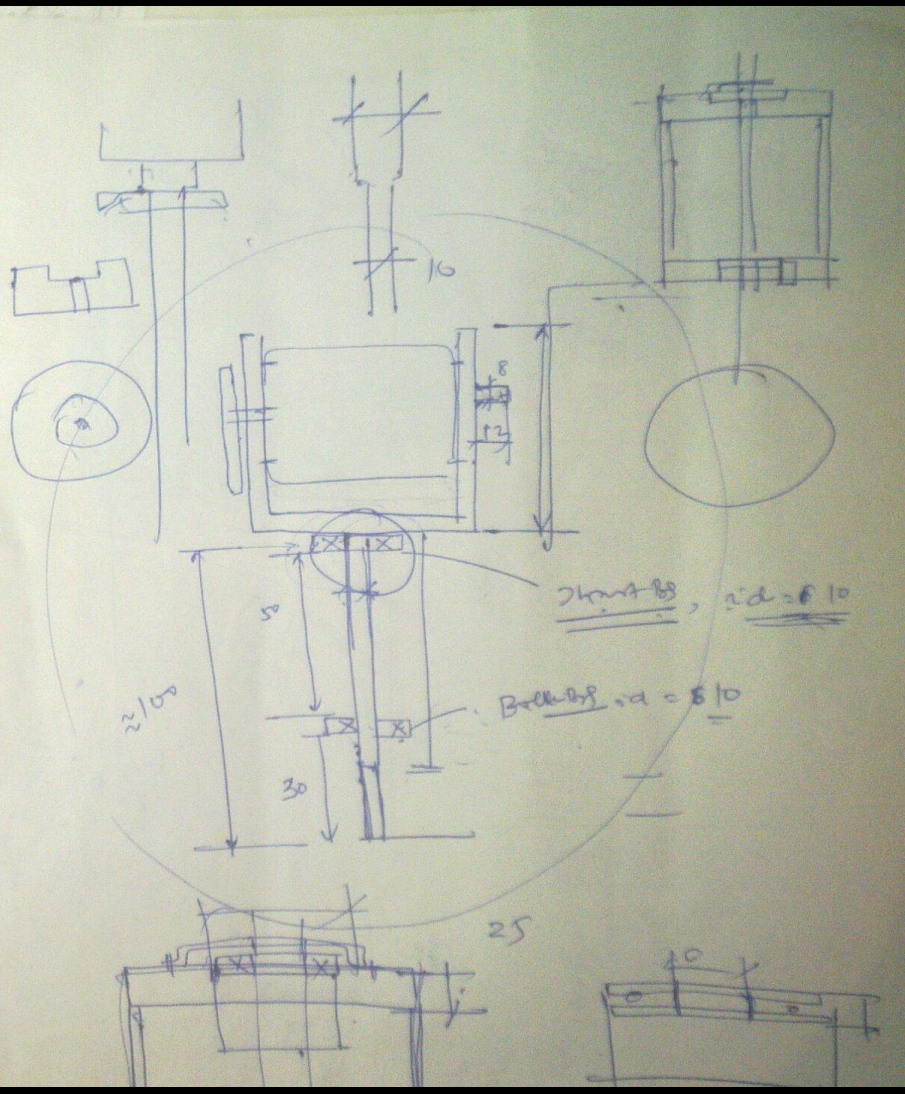
# Motivation


Lynx6 Robotic Arm
uM-FPU V3 Floating Point Coprocessor
uM-PWM1 Servo Coprocessor

# First Level Visualization



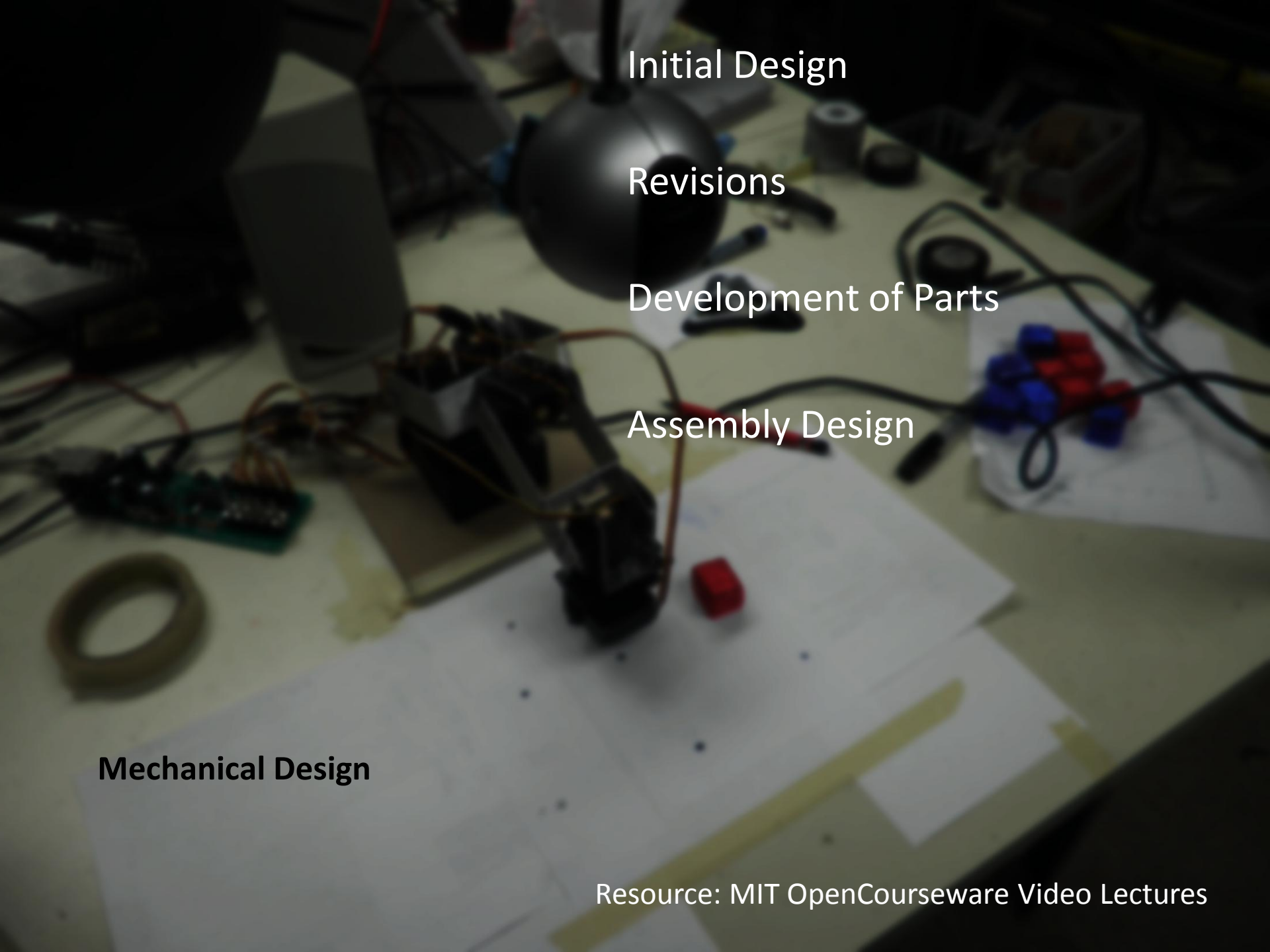

Bearing
d = 10 mm
D = 35 mm
B = 11 mm
r = 1
50
8


10
8
13
50
≈105
30
25

| | | |
|---|---|---|
| 1. | Acquisition of relevant data | *Akanksha, Ayush, Souri, Saurav* |
| 2. | Research on different Design types and choosing the best possible | *Akanksha, Saurav* |
| 3. | Decide Robot Parameters | *Ayush* |
| 4. | Verification of Parameters in Robotics Toolbox for MATLAB | *Souri* |
| 5. | *Simulation of all devices in PROTEUS* | *Ayush, Souri* |
| 6. | Implementation of Arm Parameters in LabVIEW 2010 | *Ayush, Souri* |
| 7. | Re-Verification of Arm Parameters in LabVIEW 2010 | *Saurav, Akanksha* |
| 8. | Mechanical Design of Robot | *Souri* |
| 9. | Manufacturing of Robot | *Saurav, Ayush* |
| 9. | PCB Design for Robot | *Souri , Akanksha* |
| 10. | PCB Manufacture | *Akanksha* |
| 11. | Selection of Servo Motors | *Saurav* |
| 12. | Calibration of Motors | *Souri* |
| 13. | PID Control Design and Implementation of different Modes | *Souri, Ayush, Akanksha, Saurav* |
| 14. | Improvisation | *Ayush, Souri, Akanksha, Saurav* |
| 15. | Implement further use cases and extend funcionality | *Souri, Ayush* |

Completed  Ongoing  Left

**Distributed Resposibilities**



Initial Design

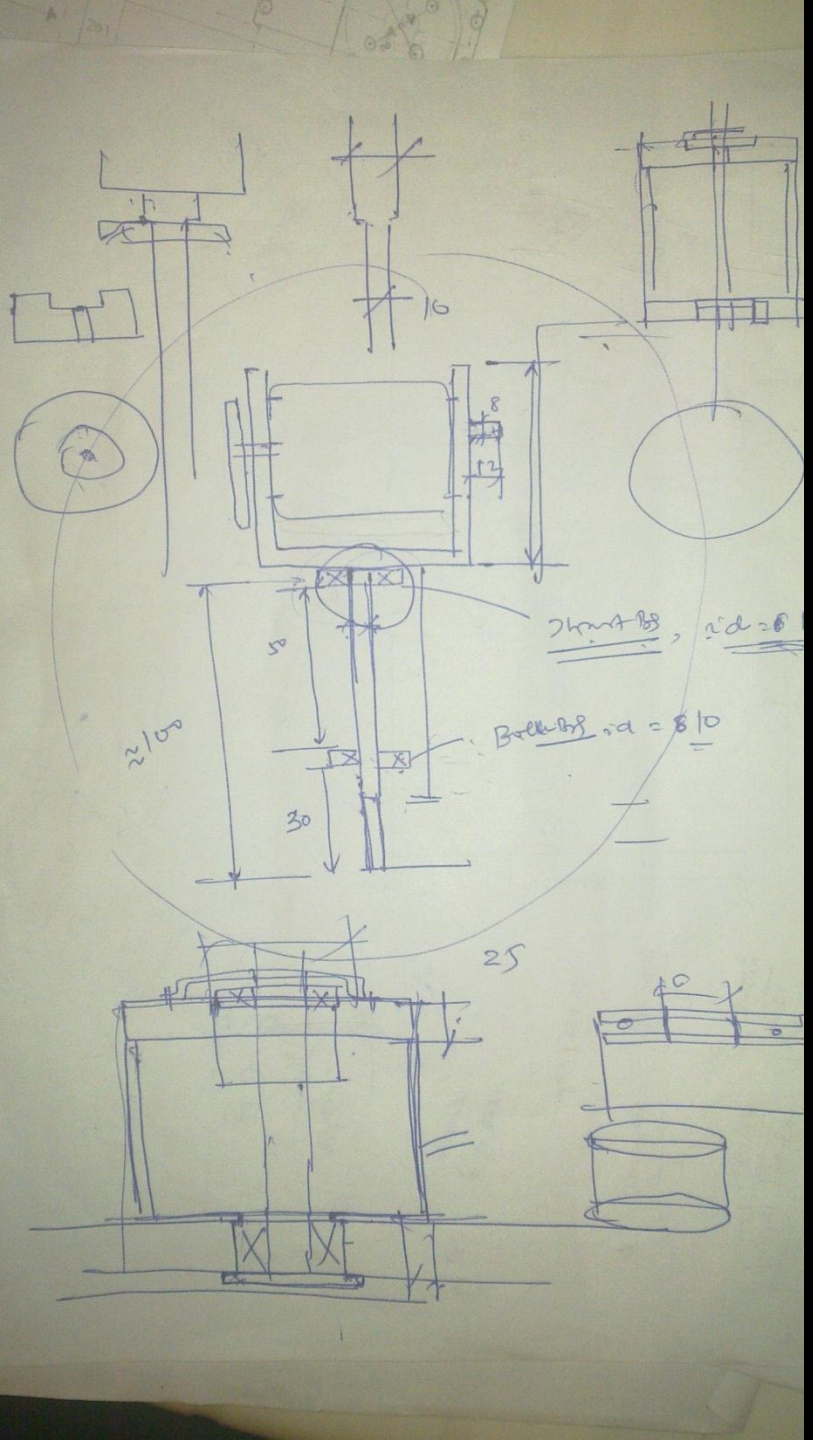
Revisions

Development of Parts

Assembly Design

**Mechanical Design**

Resource: MIT OpenCourseware Video Lectures


10
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≈105
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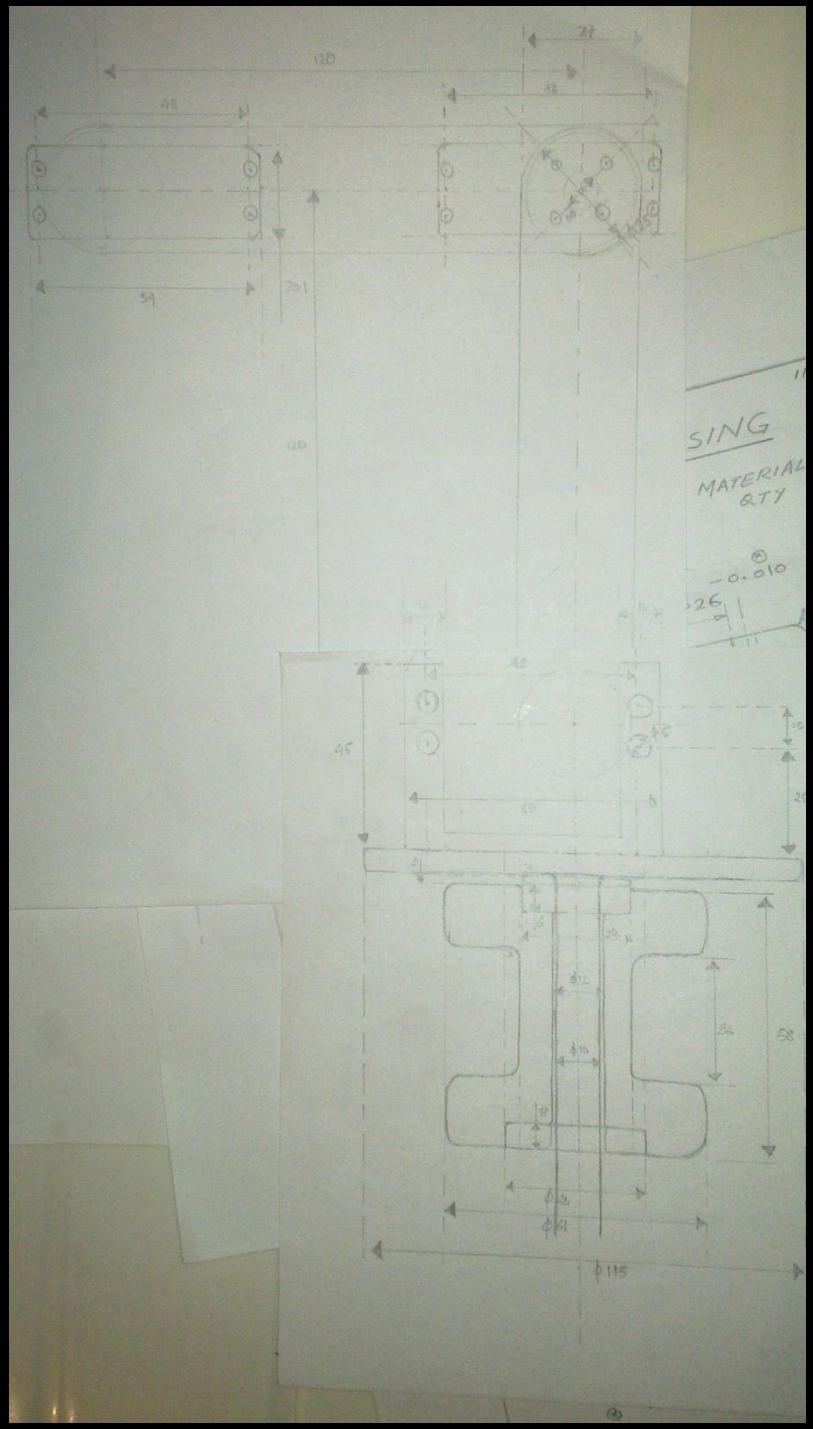
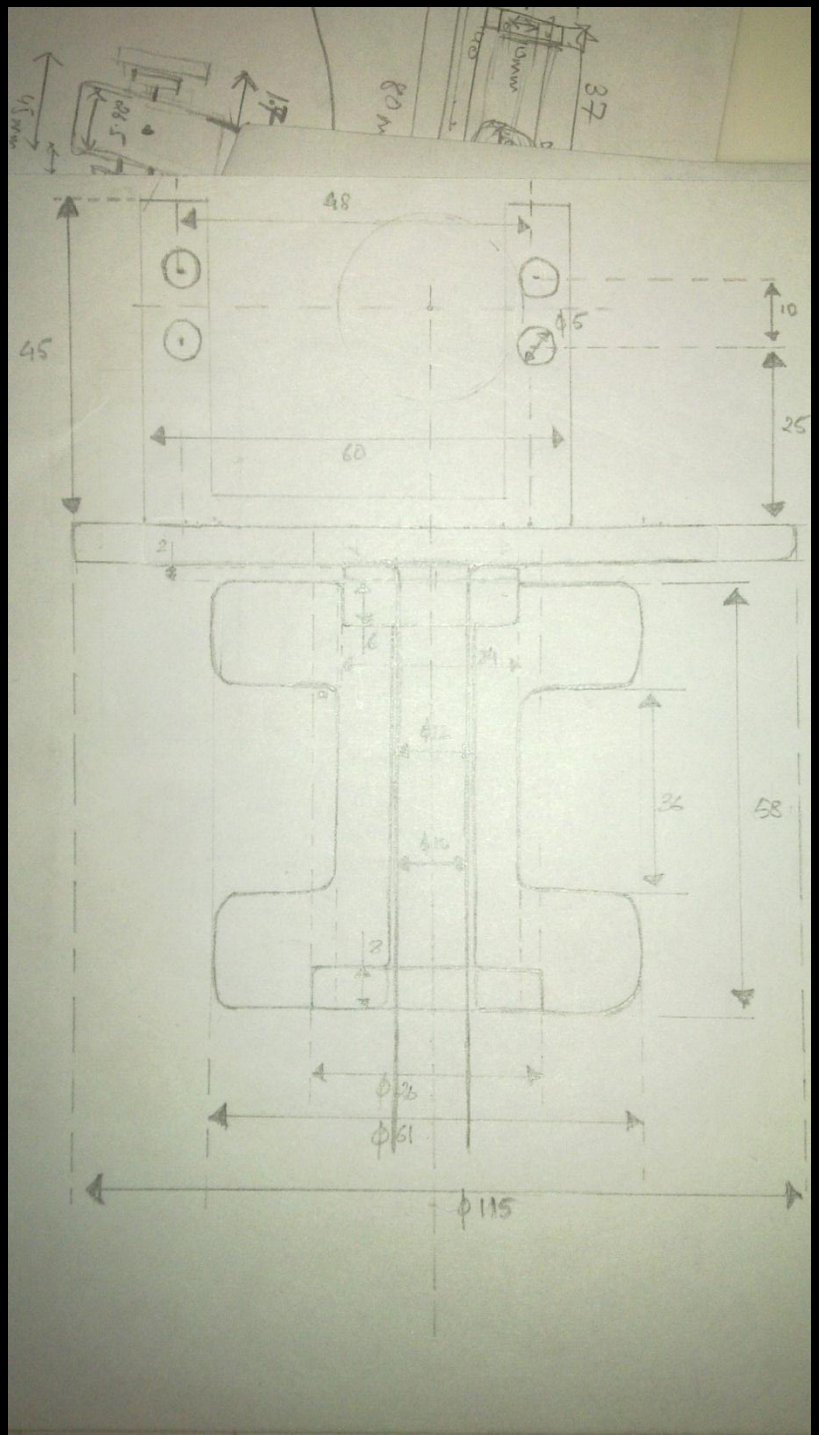
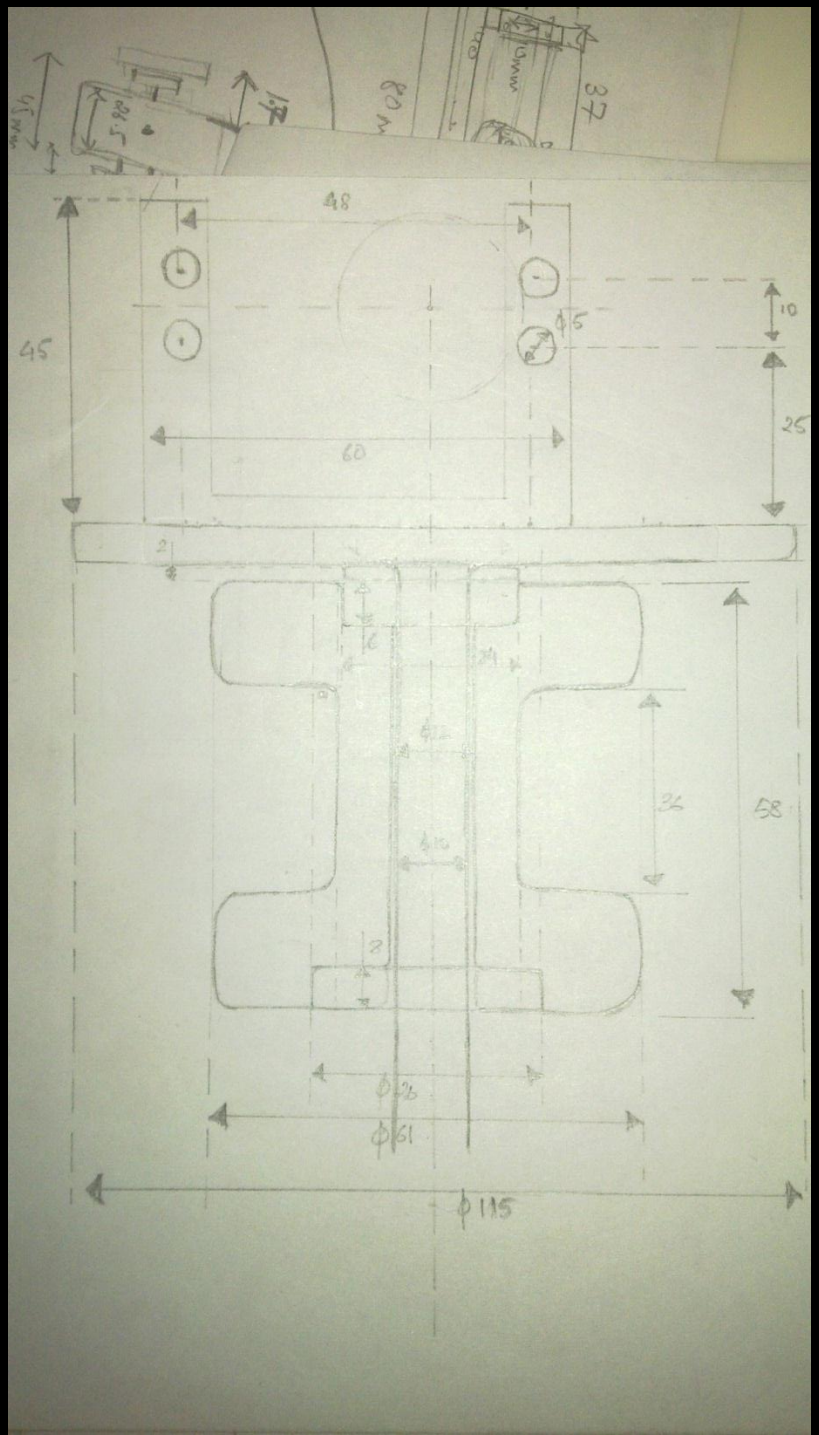
25
40


120
54
120
SING
MATERIAL
QTY
0.010
45
60
58
115

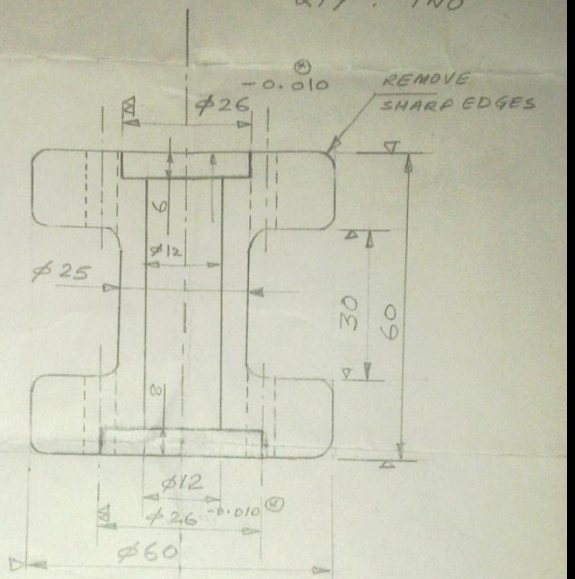

48
45
45
10
25
60
2
10
36
58
φ23
φ61
φ115

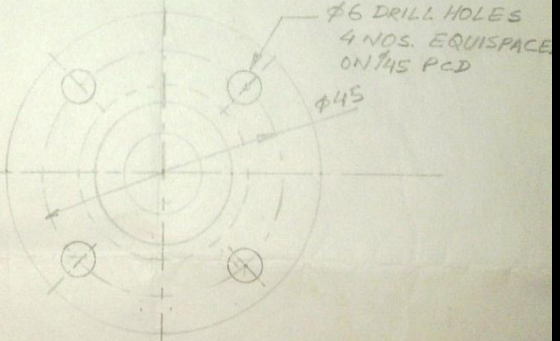

48
45
45
10
25
60
2
10
36
58
φ23
φ61
φ115

11.10.2011

# BEARING HOUSING

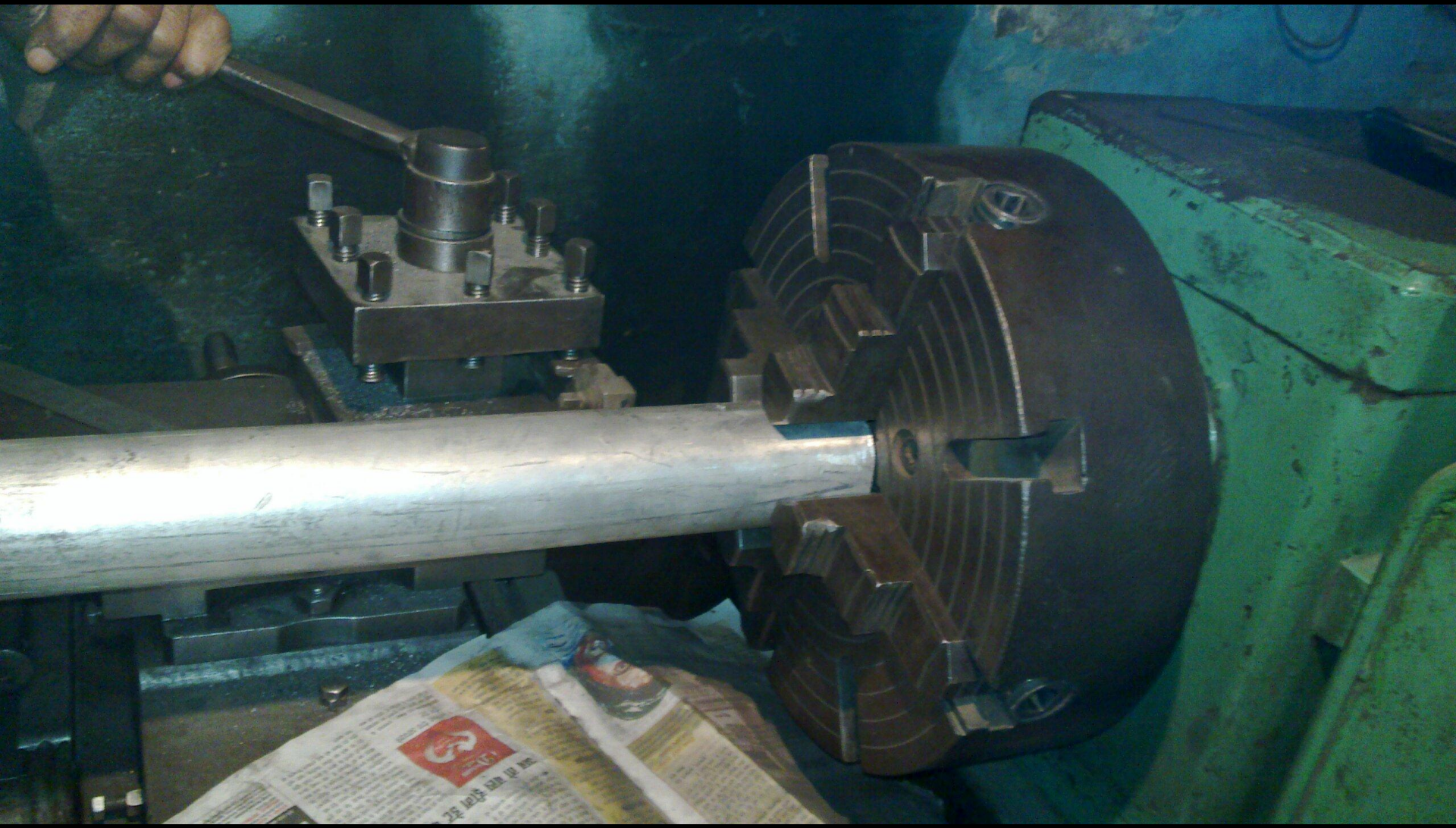
MATERIAL : MS
QTY : 1NO

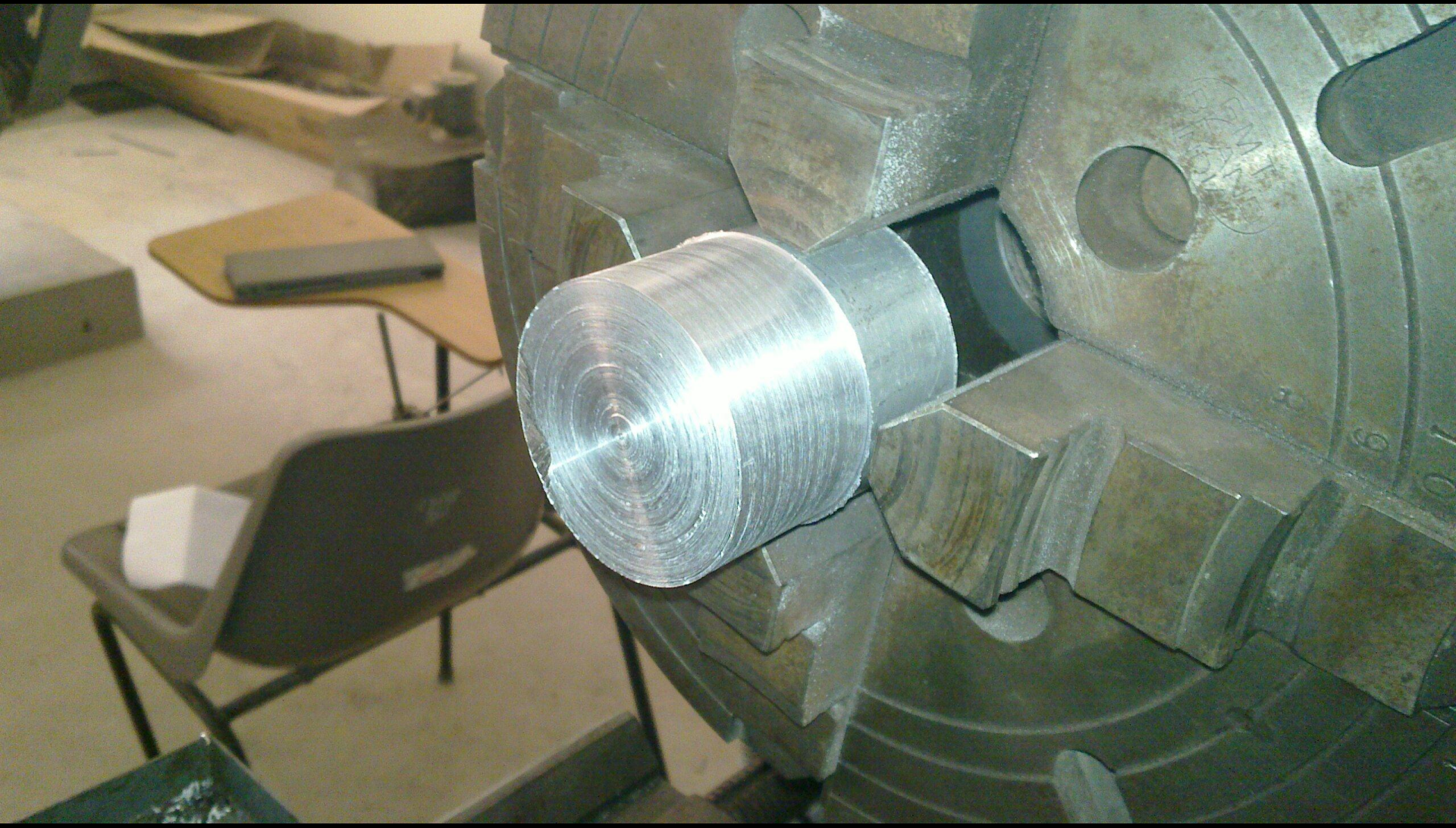



Ⓜ to be done carefully & suitably

Note :- ALL Dimensions are in mm.





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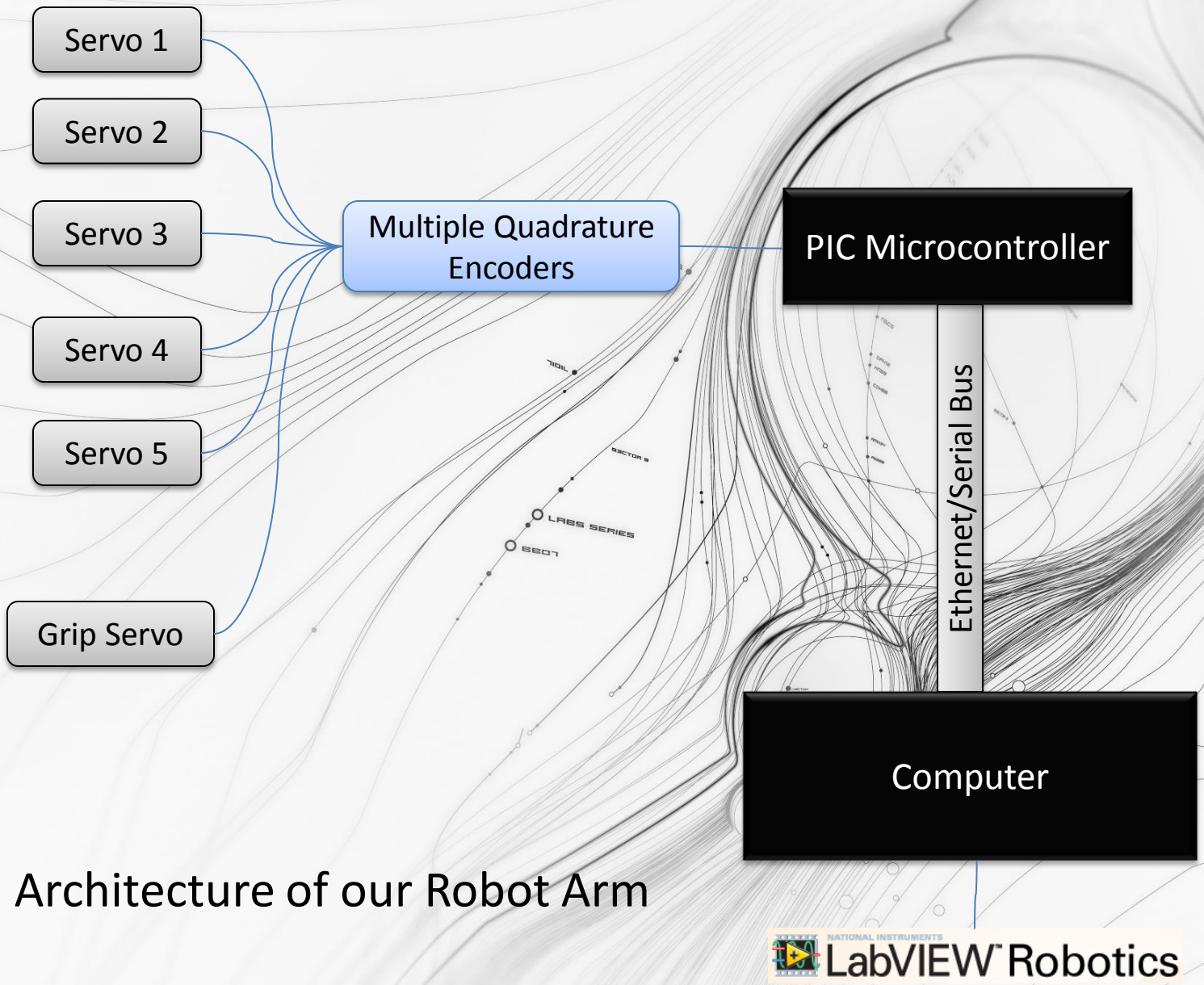
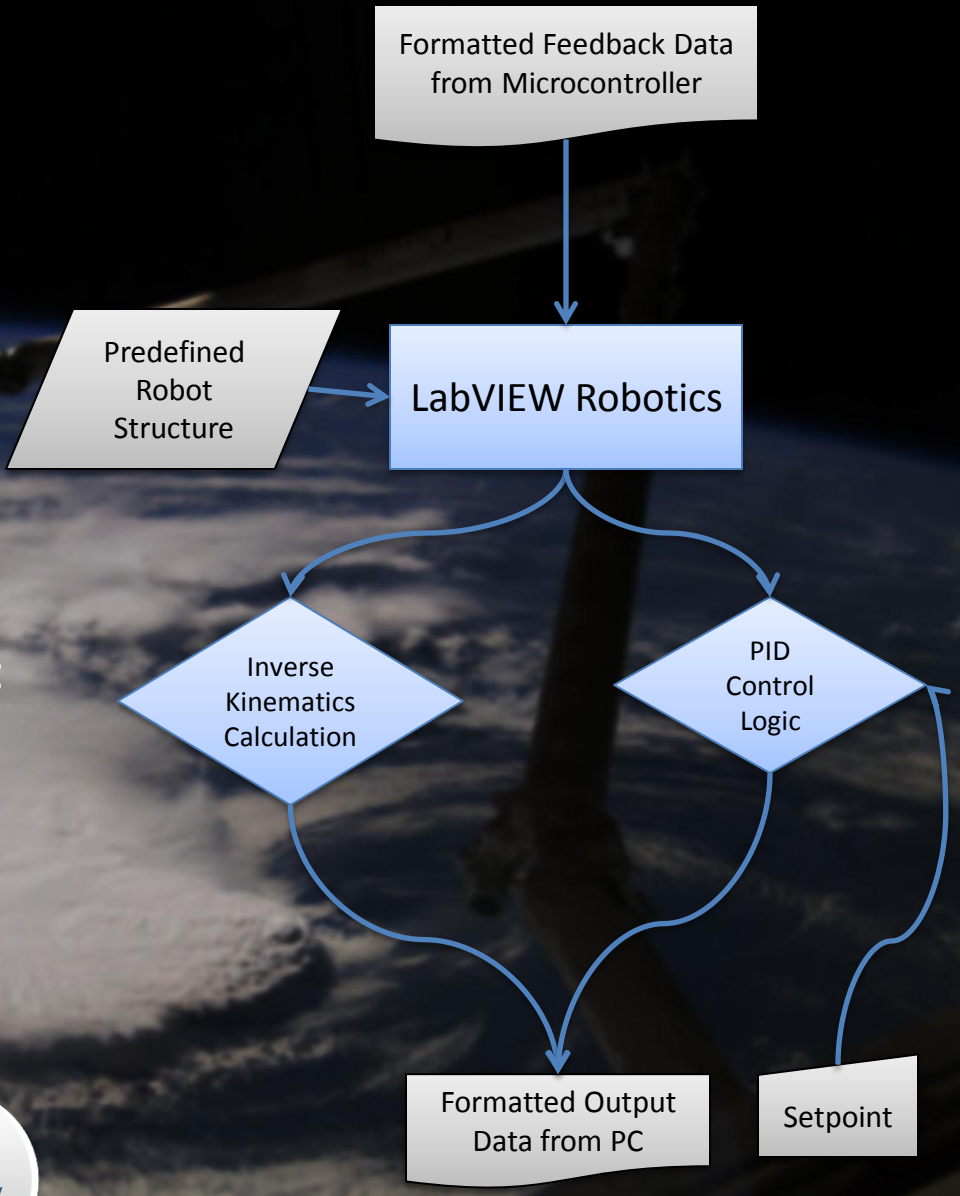
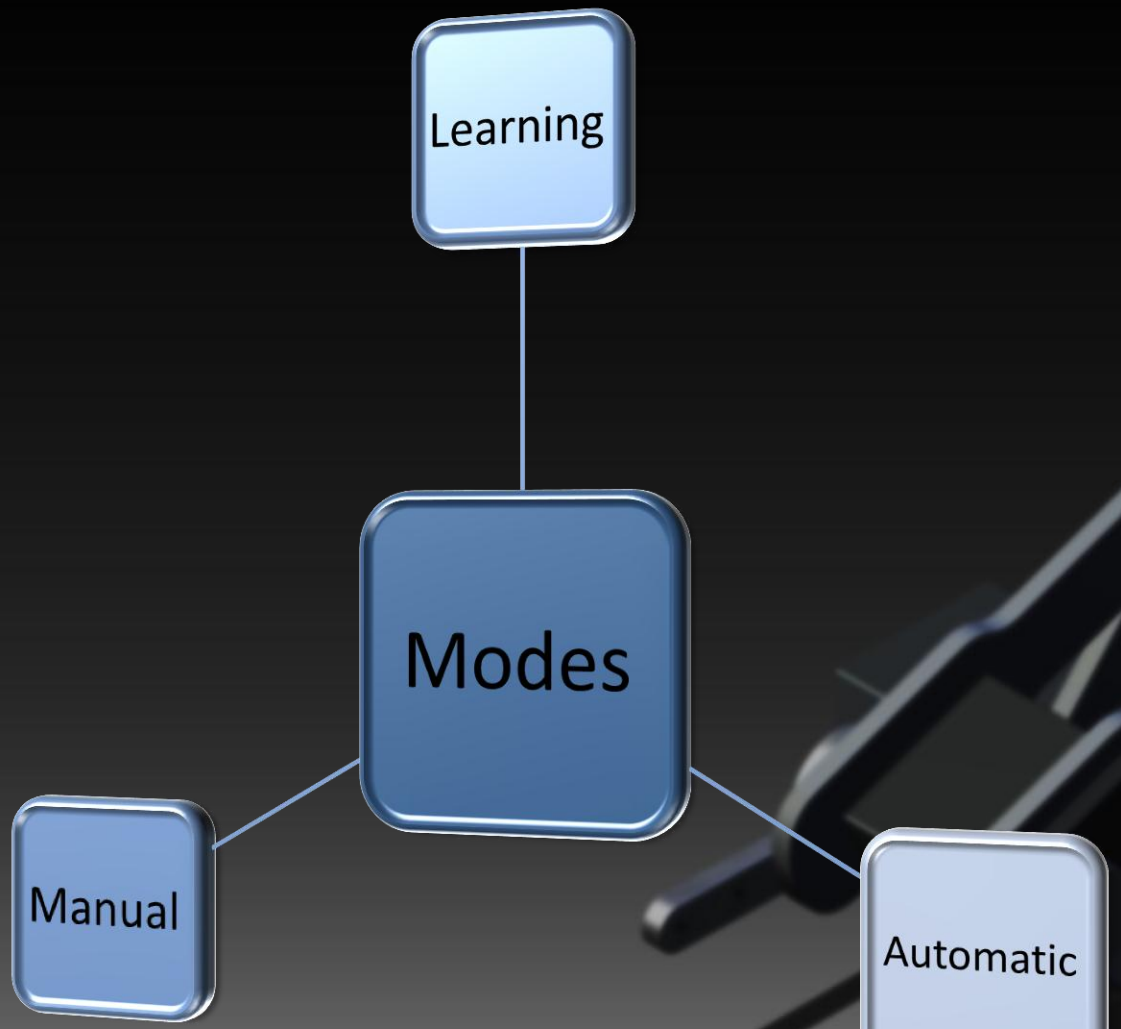



Architecture of our Robot Arm

# Software Architecture of the Robot




**Manipulation of the Robot Arm**

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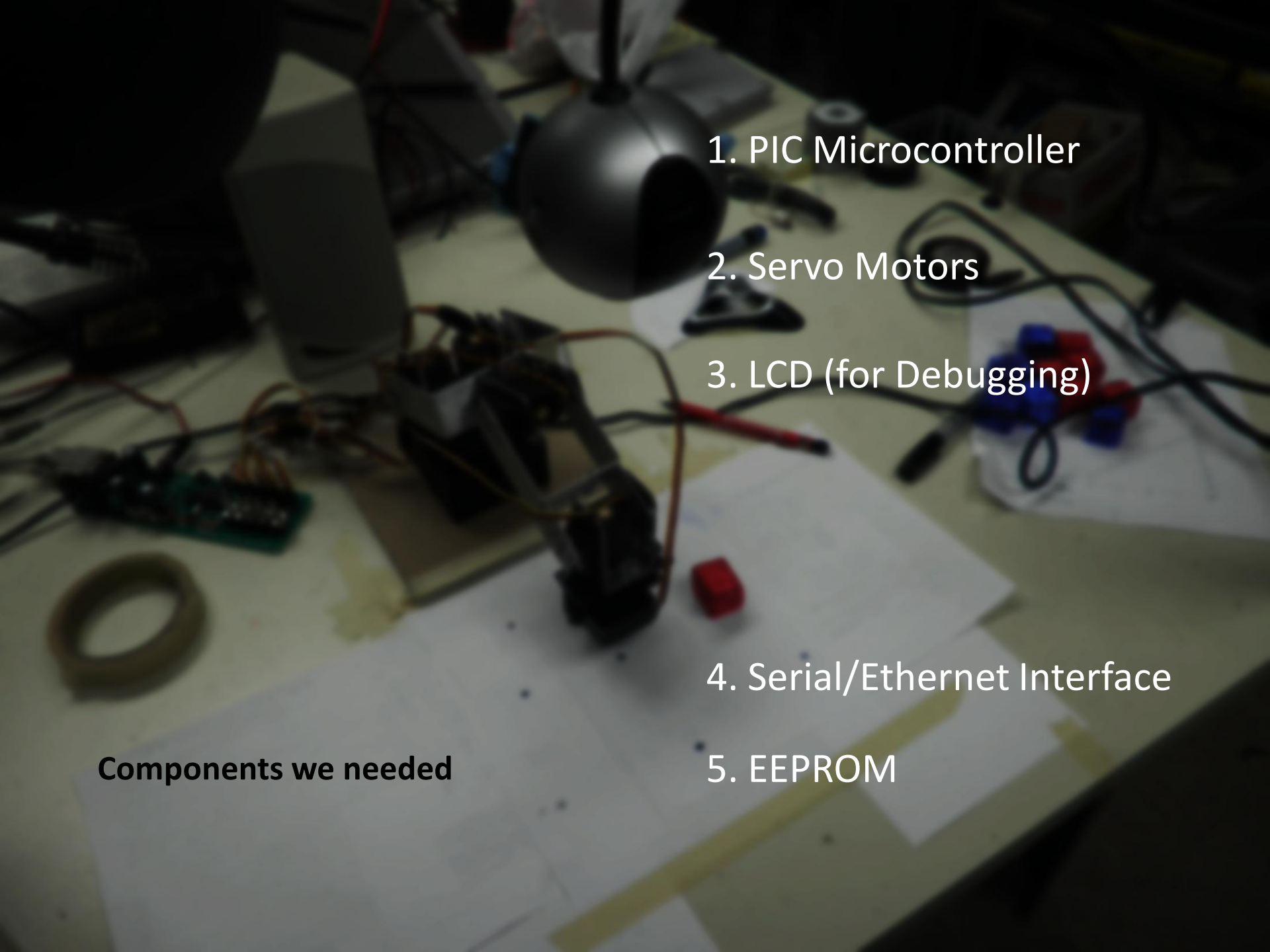
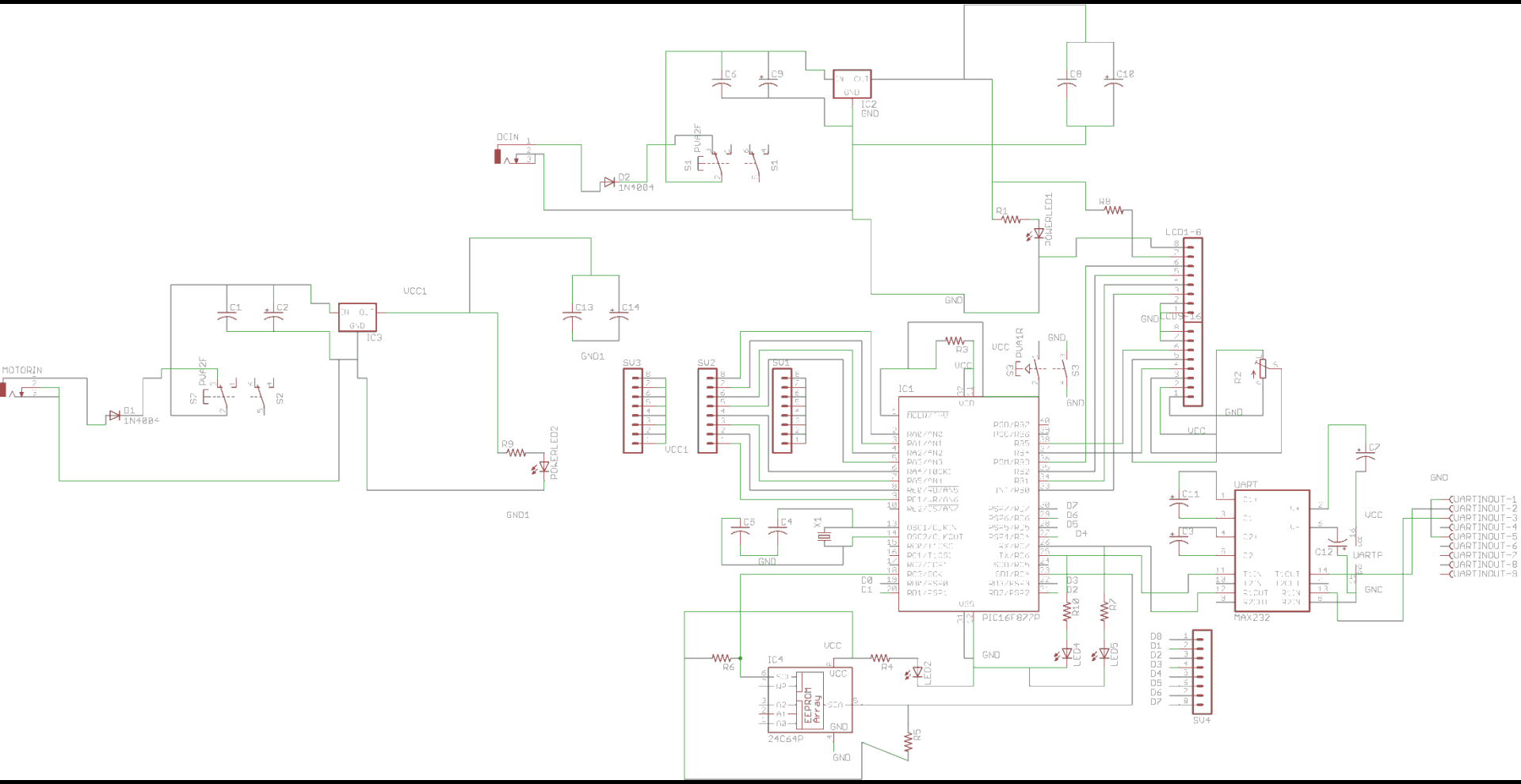
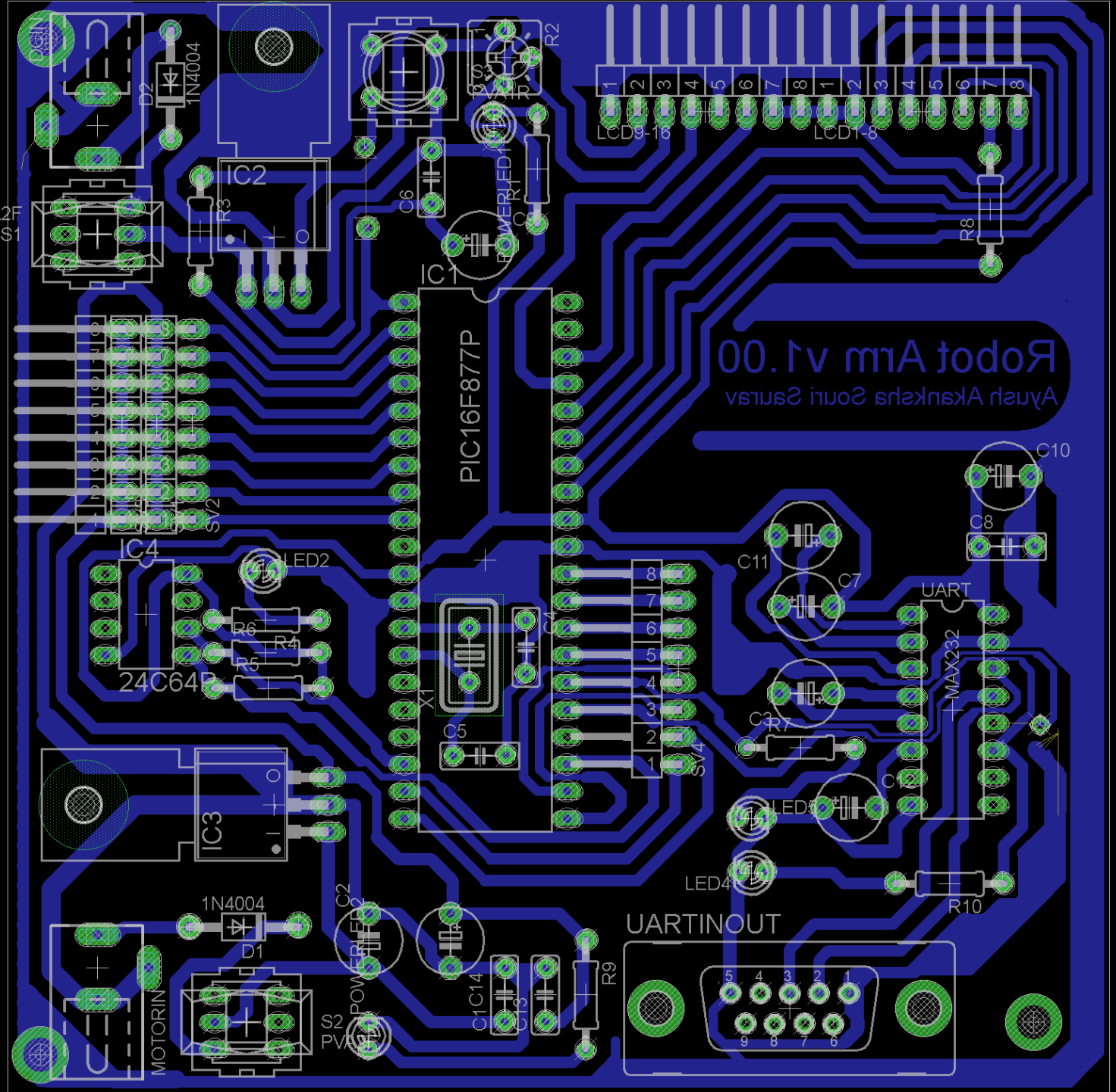


**Components we needed**

1. PIC Microcontroller
2. Servo Motors
3. LCD (for Debugging)
4. Serial/Ethernet Interface
5. EEPROM

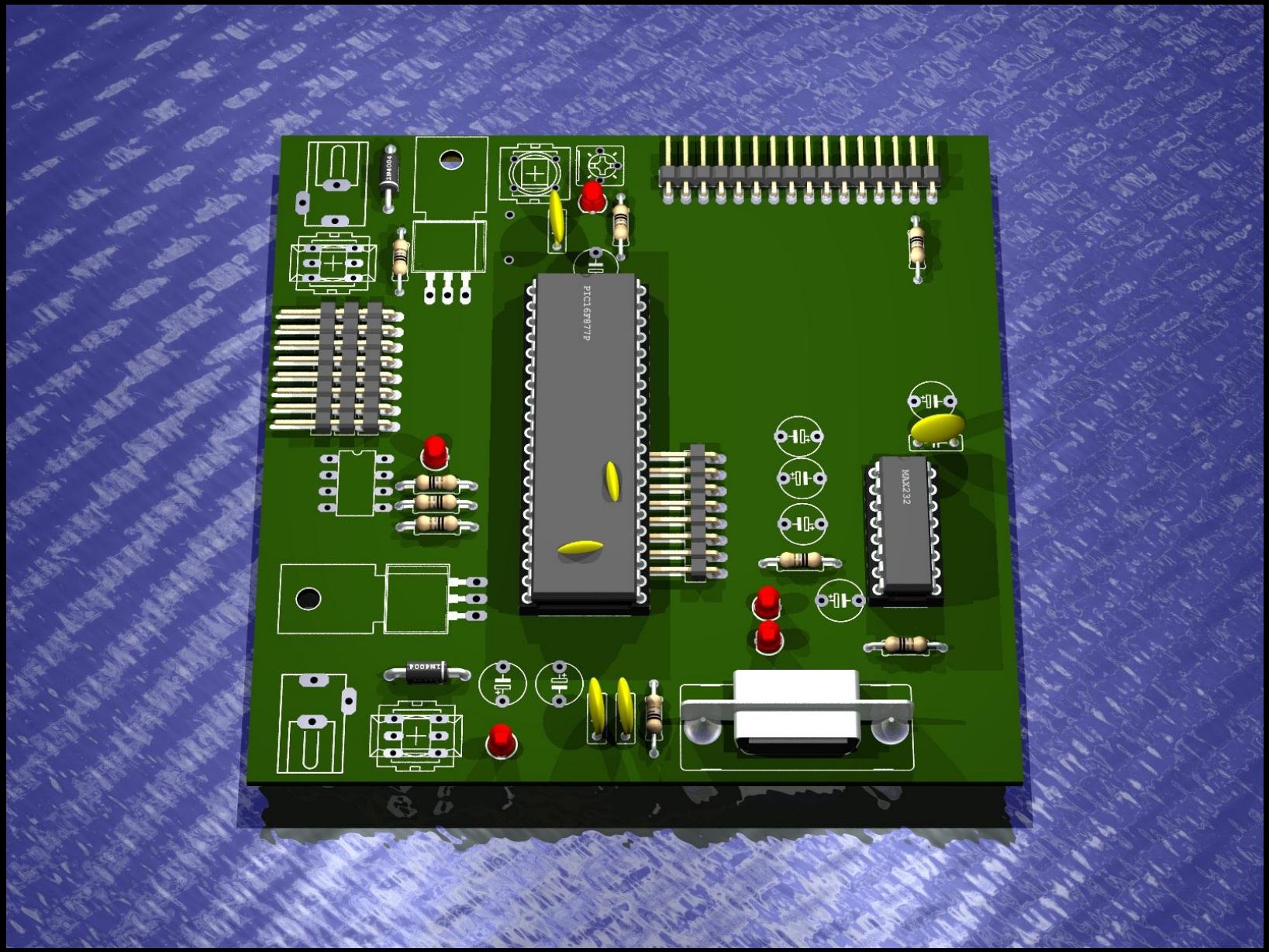
# Design of the Schematic on EAGLE



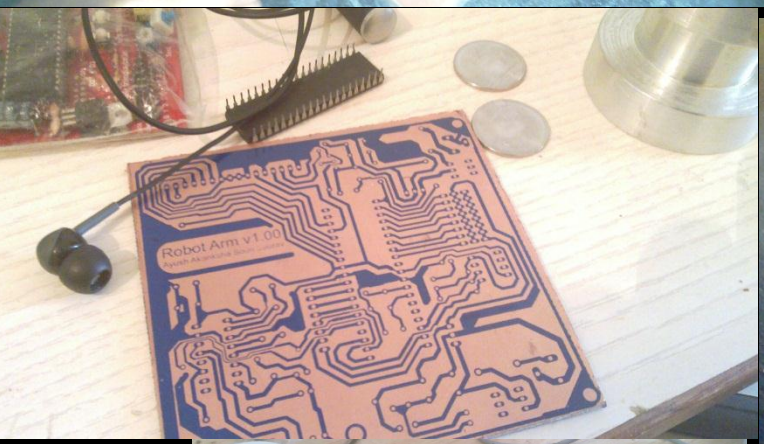

Robot Arm v1.00
Ayush Akanksha Souri Saurav
PIC16F877P
IC1
IC2
IC3
IC4
24C64P
MAX232
UART
UARTINOUT
LCD9-16
LCD1-8
PVA2F
S1
1N4004
D2
D1
LED1
LED2
LED3
LED4
POWERLED
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
C1
C2
C3
C4
C5
C6
C7
C8
C10
C11
C12
C13
C14
X1
SV1
SV2
SV3
SV4
S2
S3
MOTORIN

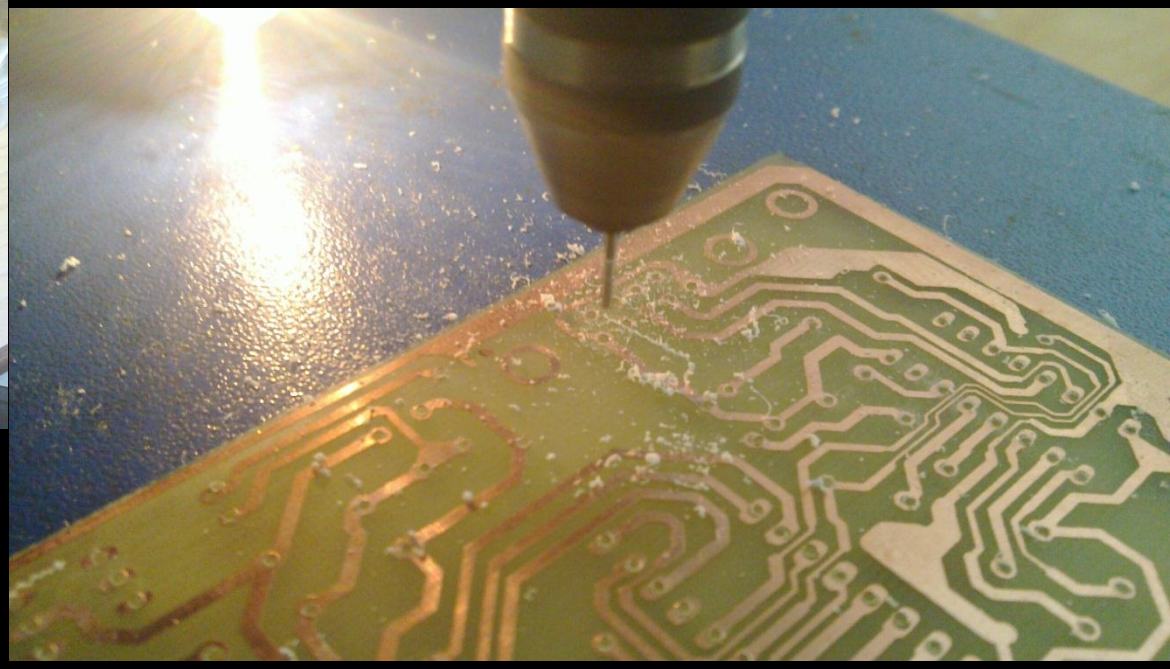
The Layout

# Generating the Layout in 3d – To prevent any misplaced component

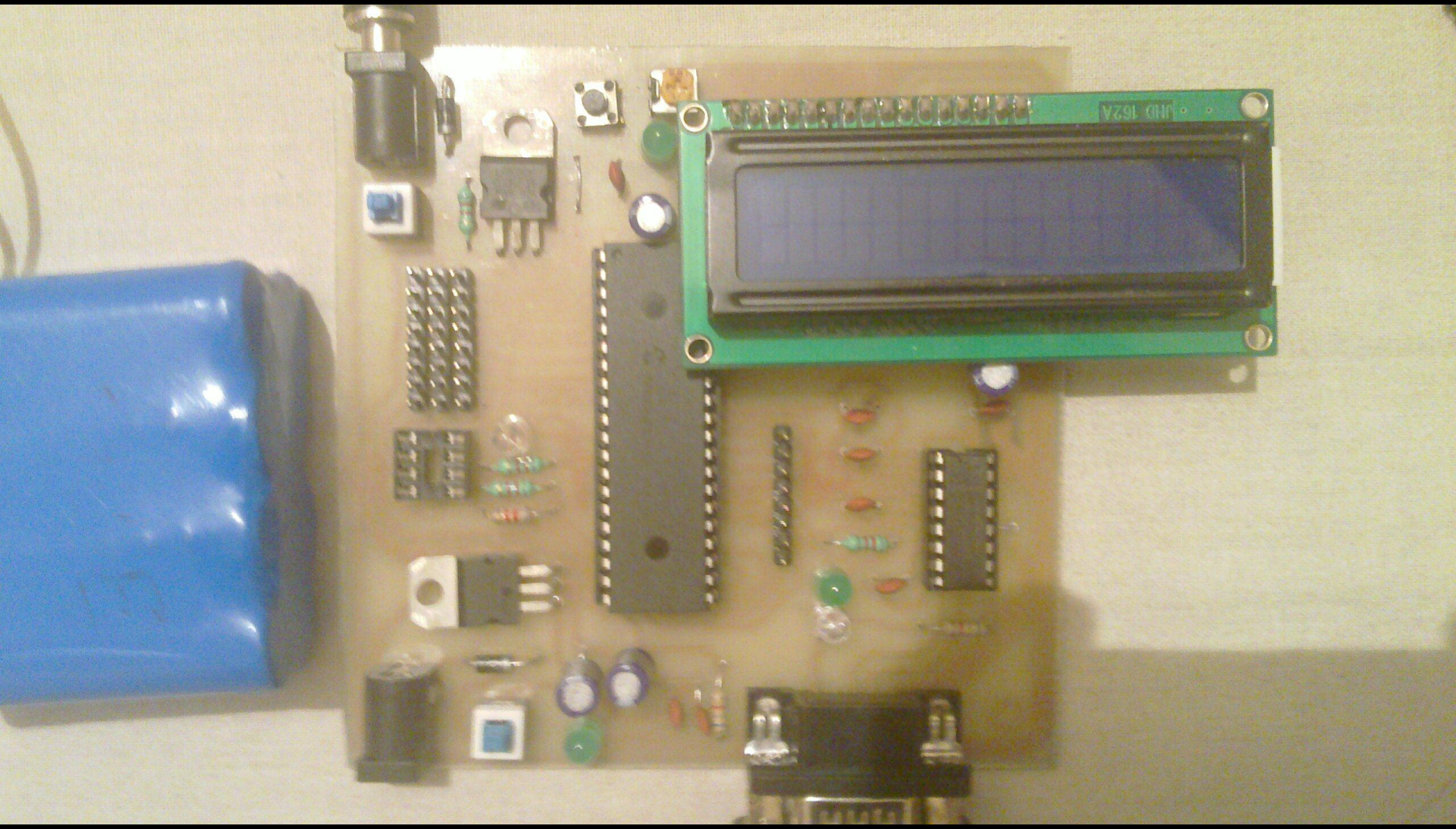


# Getting the PCB Ready



# The Final PCB



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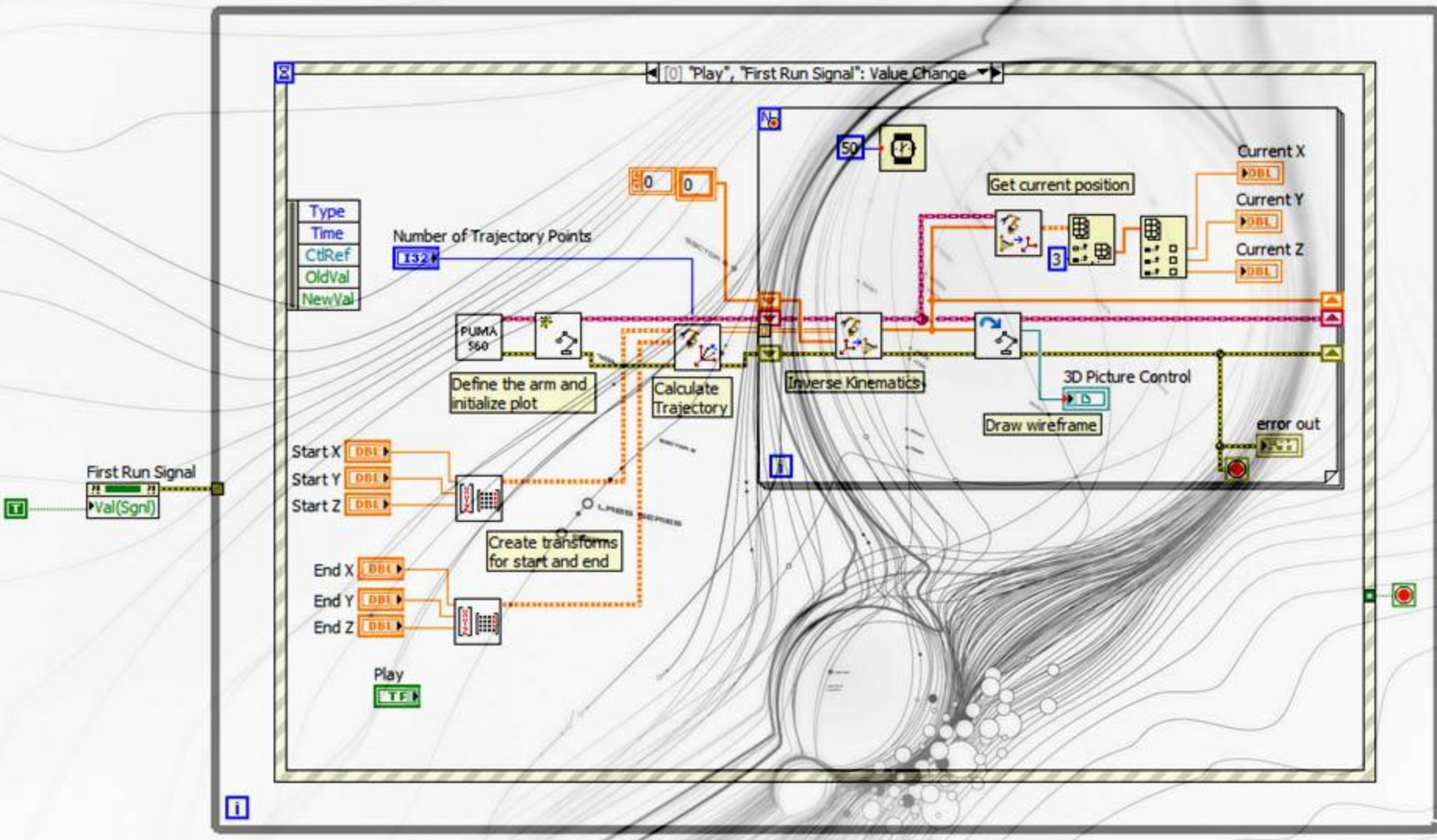
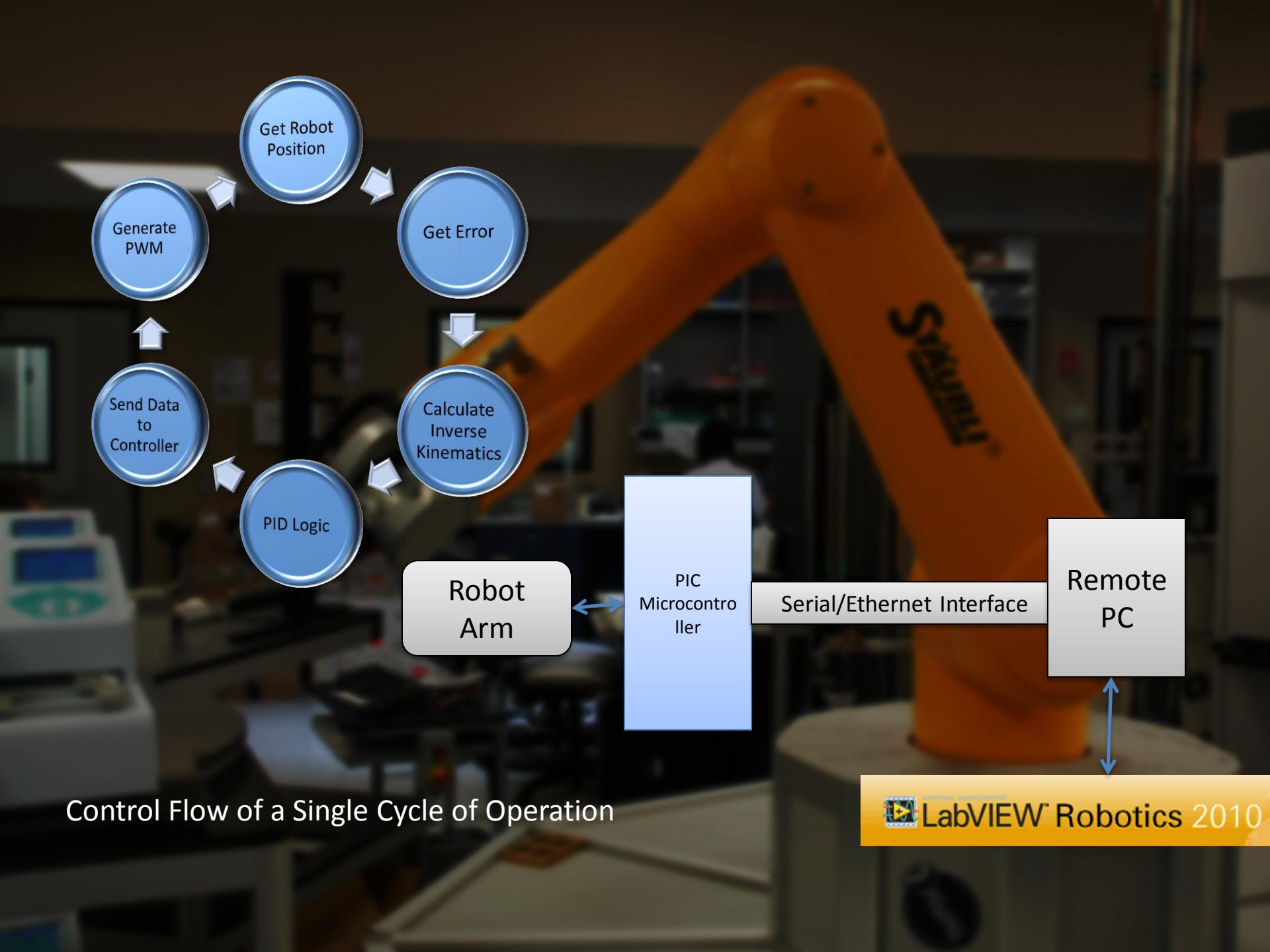



# Robot Arm Controller Design in LabVIEW

LabVIEW Robotics 2010



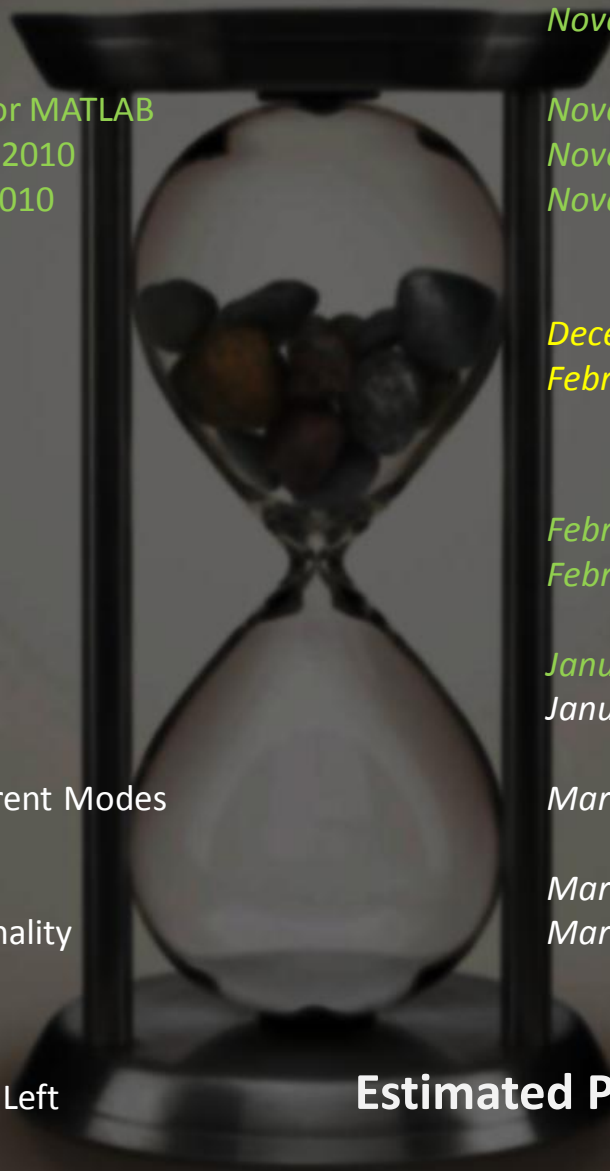

Control Flow of a Single Cycle of Operation

# Demonstration


LabVIEW Robotics 2010

# Estimated Project Timeline

| | | |
|---|---|---|
| 1. | Acquisition of relevant data | *October '10* |
| 2. | Research on different Design types and choosing the best possible | *November '10* |
| 3. | Decide Robot Parameters | *November '10* |
| 4. | Verification of Parameters in Robotics Toolbox for MATLAB | *November '10* |
| 5. | Implementation of Arm Parameters in LabVIEW 2010 | *November '10* |
| 6. | Re-Verification of Arm Parameters in LabVIEW 2010 | *November '10* |
| 7. | Mechanical Design of Robot | *December '10* |
| 8. | Manufacturing of Robot | *February '11* |
| 9. | PCB Design for Robot | *February '11* |
| 10. | PCB Manufacture | *February '11* |
| 11. | Selection of Servo Motors | *January '11* |
| 12. | Calibration of Motors | *January '11* |
| 13. | PID Control Design and Implementation of different Modes | *March '11* |
| 14. | Improvisation | *March-April '11* |
| 15. | Implement further use cases and extend funcionality | *March-April '11* |



Completed  Ongoing  Left


thank You!