



# GUJARAT TECHNOLOGICAL UNIVERSITY

CHANDKHEDA, AHMEDABAD  
AFFILIATED

## G. H. PATEL COLLEGE OF ENGINEERING & TECHNOLOGY

A Project on  
**“MOTION CLONING”**  
(User Defined Project)

Under the subject of  
**PROJECT-I (2170001)**  
B.E. IV, Semester – VII  
MECHATRONICS  
TEAM ID: 66117

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**ACADEMIC YEAR: 2019-2020**

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# **ACKNOWLEDGEMENT**

We appreciate **GTU** for giving us a platform, which can transform our idea into a design or any product, which can help people in their day-to-day life.

The success of any task depends on the efforts made by team members but it cannot be achieved without the cooperation of other people who are supportive. So, we would like to thank **G. H. Patel College of Engineering & Technology** for giving us the opportunity of doing this project.

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We are also thankful to our workshop teachers and Non-teaching staff for their valuable time and help for completion of the project.

Once again, we are grateful to all those without whom this work would not have been completed successfully.

# **COLLEGE CERTIFICATE**

Date:

This is to certify that the project entitled “MOTION CLONING” has been carried out by SAGAR DESAI (160110120008), JASH SACHDEV (160110120052), MAHARSHI THAKRAR (160110120059) and NISARG UPADHYAY (160110120060) under our guidance in fulfilment for the degree of Bachelor of Engineering (7th Semester) of Gujarat Technological University, Ahmedabad during the Academic year 2019-20.

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**ACADEMIC YEAR: 2019-2020**

# **UNDERTAKING ABOUT ORIGINALITY OF WORK**

We hereby certify that we are the sole authors of this UDP project report and that neither any part of this UDP project report nor the whole of the UDP Project report has been submitted for a degree by other student(s) to any other University or Institution.

We certify that, to the best of our knowledge, the current UDP Project report does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations or any other material from the work of other people included in our UDP Project report, published or otherwise, are fully acknowledged in accordance with the standard referencing practices. Furthermore, to the extent that we have included copyrighted material that surpasses the boundary of fair dealing within the meaning of the Indian Copyright (Amendment) Act 2012, we certify that we have obtained a written permission from the copyright owner(s) to include such material(s) in the current UDP Project report and have included copies of such copyright clearances to our appendix.

We have checked the write up of the present UDP Project report using anti-plagiarism database and it is in the allowable limit. In case of any complaints pertaining to plagiarism, we certify that we shall be solely responsible for the same and we understand that as per norms, University can even revoke BE degree conferred upon the student(s) submitting this IDP/UDP Project report, in case it is found to be plagiarized.

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Place: G. H. Patel College of Engineering & Technology Date:

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Dr. Falgun Thakkar  
(Project Guide)

## **ABSTRACT**

There are many places where it requires human precision and accuracy but those places and environments are sometimes inaccessible and risky to human health. There are technologies which are used to mimic the human motion for such kinds of jobs. For the motion to replicate, the operator has to wear some kind of hardware on his body part whose motion is then transferred to the mechanical body part. Here we want to make the same application without any hardware interaction between the operator and device that controls the robotic hand for various application. We are trying to create the motion with the help of the camera or a sensor where the operator just has to do the motion in the space, that motion is then captured by the camera. And from the change in the pixel distance between the predesignated nodes in real time and space from every frame, that distance is then converted in the mechanical motion with precision.

# **1- INTRODUCTION**

## **A. ADDITIVE MANUFACTURING**

### **1. 3D Printing**

#### **ADDITIVE MANUFACTURING**

In this type method, material is added (extruded) to produce a part.

The **3D Printing** method used here is FDM (Fused Deposition Modelling) wherein a filament made up of ABS/PLA is heated to melt the filament and is then deposited layer by layer at a time.

## **1.1 Problem Summary**

Engineers, who make projects for their curricular as well as for their own learning purposes, usually divide their work in 3 stages i.e. **Designing, Manufacturing Parts & Assembling Parts.**

The first stage is easy as the student himself is designing the project & thus can do it according to his/her requirement. The next stage i.e. **manufacturing the parts.**

Here is where the problem arises as students do not have access to the different machines with different capabilities for their needs, nor do they have enough money to invest in so much costly machines & space to keep those machines. Outsourcing the machining of parts is also too costly.

Thus, what the students do is either compromise their design or use traditional methods to make their parts, which results in poor quality of parts, decreases the accuracy of parts& also consumes hours of tedious hard work.

This problem not only applies for engineers, but also to:

- Architecture students for making their models

- Small scale Industries to make & design new products
- Hobbyists creating innovative projects

## **1.2 Aim & Objective**

**AIM: To mimic the motion of a human hand in a robotic hand without any direct hardware contact.**

### **OBJECTIVES:**

- Portability
- Should be accurate and precise
- Cost effective compared to other available
- Minimum hardware requirement

## **1.3 Outcomes of the project**

- After the completion of the project, the part can be used in following ways:
  1. It can be used in Military operations.
  2. In Industries.
  3. Places where Humans cannot have access but requires their personal experience.
  4. Can be used in applications of Augmented Reality.
  5. If modified further, it can be used in Hospitals for Surgeries.



## **1.4 Scope of Future Work**

If Camera can detect precise human body movements with real time without any lag in transmission of the data then it can interact with the far situated humanoid robotic body and can be applied at the places where humans can't reach or their bodies aren't suitable in the environment.

## **1.5 Working Principle**

The Camera with proper edge detection algorithm to find the pixel distance between predefined nodes that can replicate the motion in real time and space due to the change in pixel distance in a particular direction.

When pixel distance will get changed between 2 nodes it gives an output between both x-y coordinates using Euclidean or Manhattan distance, it gives us a particular value that specify distance according to our predefined resolution grid.

This data which is in the form of distance vector from a particular point is converted in an angular form for rotation of the servo motor.

## **1.6 Materials / Tools required**

<b>Product</b>	<b>Quantity</b>
<b>Arduino Uno</b>	<b>1</b>
<b>Leap Motion</b>	<b>1</b>
<b>MG995r Servo</b>	<b>7</b>
<b>Braided fishing line</b>	<b>5 m</b>
<b>Dark Black PLA</b>	<b>4 Kg.</b>
<b>Bolts and Nuts</b>	<b>-</b>
<b>Drill and finishing kit</b>	<b>1</b>
<b>Servo Board controller</b>	<b>1</b>

# DESIGN: ANALYSIS, DESIGN METHODOLOGY AND IMPLEMENTATION STRATEGY

## 2.1 AEIOU Framework

AEIOU Summary:

Group id:

Date:

Sheet No:

Project Name :

Environment :	Interactions :	Objects:	
DIRECT SUNLIGHT	DOCTORS	LEAP MOTION SENSER	3D PRINTED PARTS
HUMIDITY	RESCUES	ARDUINO UNO	POWER REGULATOR
RAINY WEATHER	RED DEPARTMENT	SERVO MOTORS	LI-PO BATTERY
MUDDY AREA.		CABLES	CAMERA.

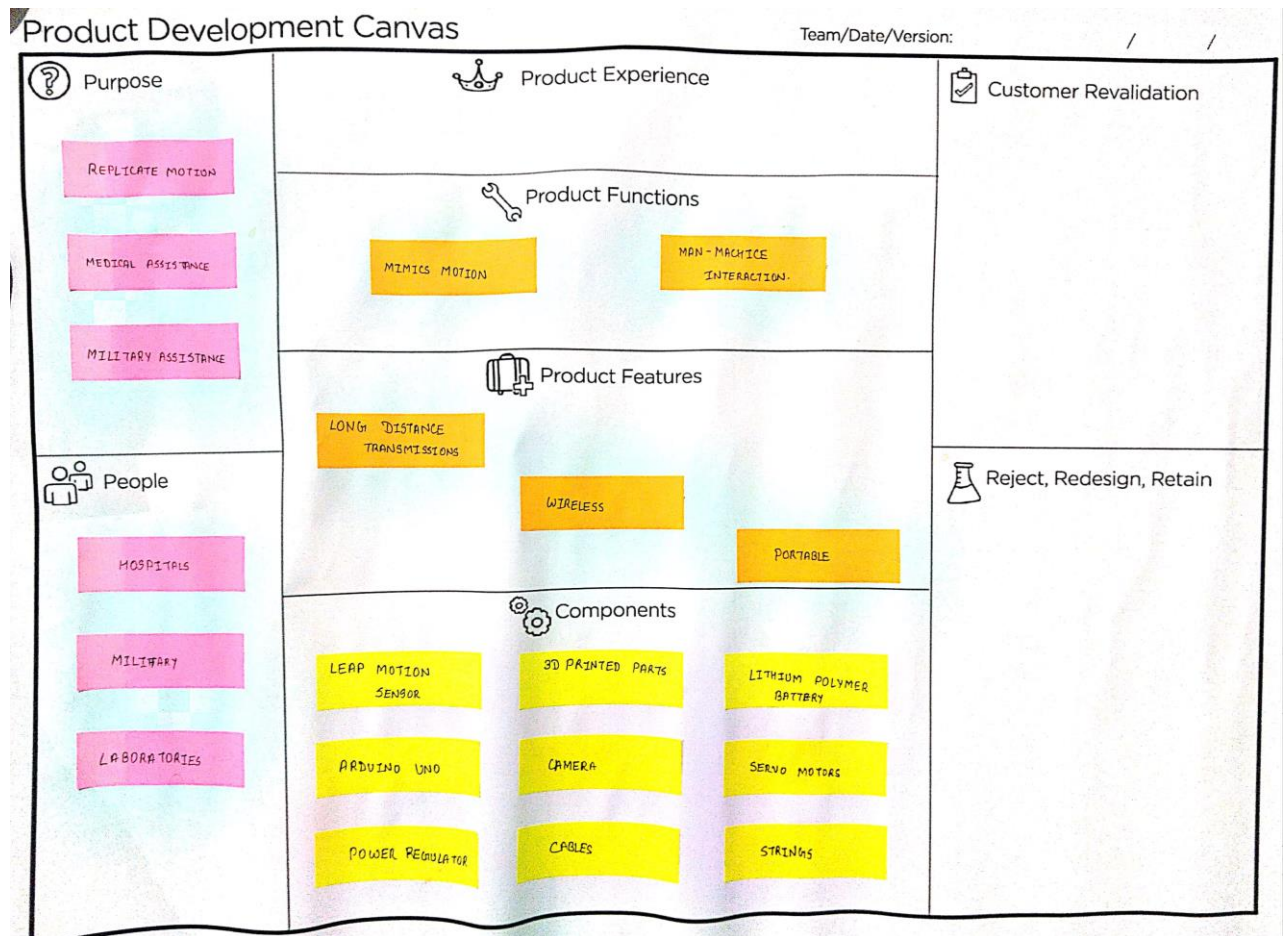
  

Activities :	Users :	
REPLICATES MOTION	HOSPITALS	RESEARCHERS.
MEDICAL ASSISTANT	RESCUE MISSIONS	
OPERATION PERFORMING		

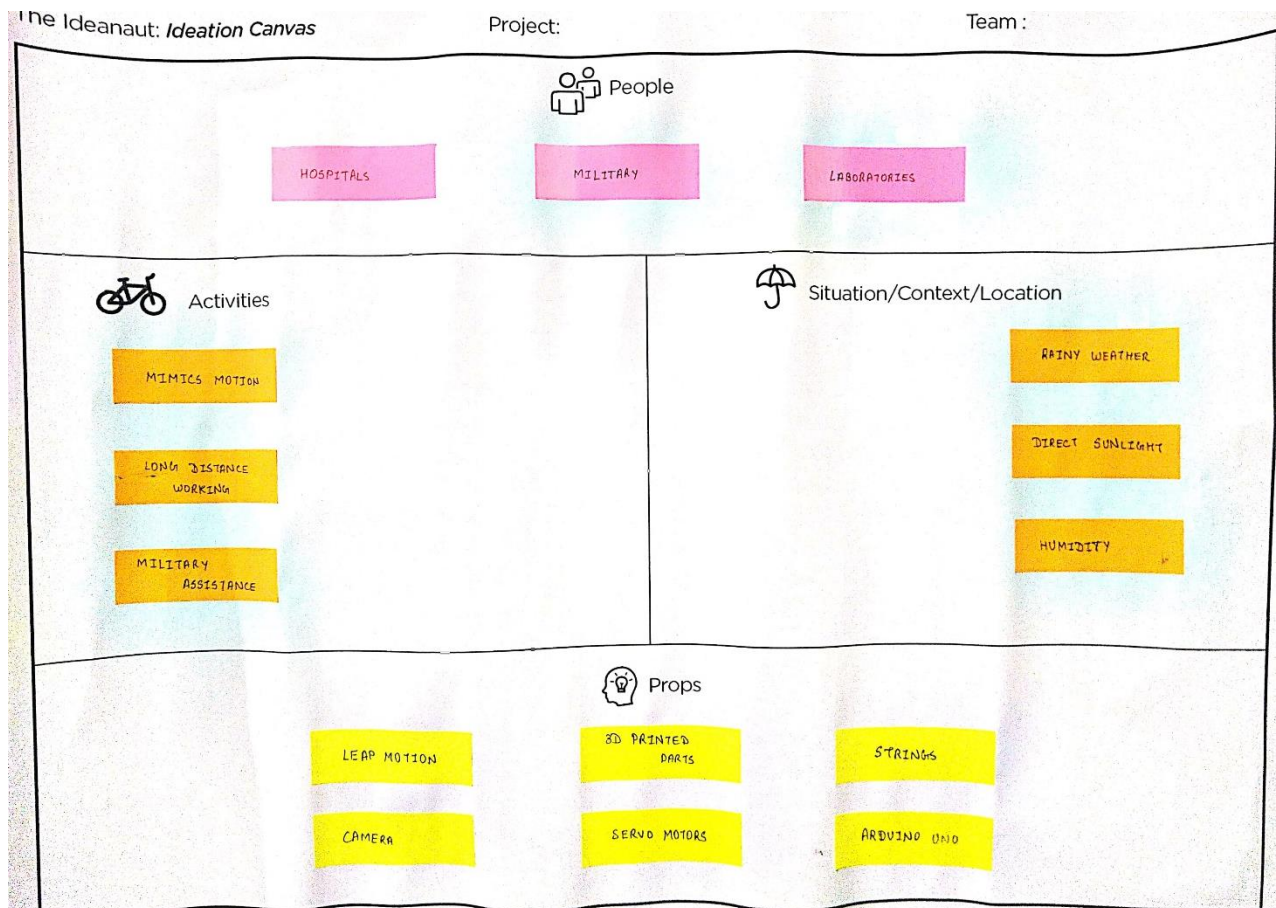
## 2.2 Empathy Mapping Canvas

Date	Version
<b>USER</b> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; background-color: #FFDAB9; margin: 5px;">HOSPITALS</div> <div style="border: 1px solid black; padding: 5px; background-color: #FFFFE0; margin: 5px;">MILITARY</div> </div> <div style="border: 1px solid black; padding: 5px; background-color: #FFDAB9; margin: 5px; text-align: center;">LABORATORY</div>	<b>STAKEHOLDERS</b> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; background-color: #FFDAB9; margin: 5px;">GOVERNMENT</div> <div style="border: 1px solid black; padding: 5px; background-color: #FFDAB9; margin: 5px;">R&amp;D DEPARTMENT</div> </div> <div style="border: 1px solid black; padding: 5px; background-color: #FFFFE0; margin: 5px; text-align: center;">INDUSTRIALISTS</div>
<b>ACTIVITIES</b> <div style="display: flex; justify-content: center; align-items: center; margin: 10px 0;"> <div style="border: 1px solid black; padding: 5px; background-color: #FFFFE0; margin: 5px;">MIMICS MOTION</div> </div> <div style="display: flex; justify-content: center; align-items: center; margin: 10px 0;"> <div style="border: 1px solid black; padding: 5px; background-color: #FFDAB9; margin: 5px;">LONG DISTANCE TRANSMISSIONS</div> </div> <div style="display: flex; justify-content: center; align-items: center; margin: 10px 0;"> <div style="border: 1px solid black; padding: 5px; background-color: #FFDAB9; margin: 5px;">MILITARY ASSISTANCE</div> </div>	
<b>STORY BOARDING</b> <b>HAPPY -1</b> <p>So the panel of doctors decided to operate him through this new technology is Motion Cloning with which the doctor can just operate the patient by looking at a screen and doing the gestures in front of the sensor. And a hardware designed like an actual hand will do the operation at the required place on the patient. Like that the patient's treatment was done on time through sensor connections.</p>	
<b>HAPPY-2</b> <p>At that time, in the scenario this tech was planned to be used that the hand setup was kept in front of the explosive and a person from bomb squad tried to defuse it by sitting at a different place by his hand gestures &amp; Movements. By this the life risk was reduced and bomb was also defused.</p>	
<b>SAD -1</b> <p>Once there was a patient, suffering from a severe disease and condition arised that he had to go through a very complex operation and that too an immediate situation. And there were very few doctors who could operate him and none of them were available and their travelling would take a long time to reach him.</p>	
<b>SAD -2</b> <p>Once in a crowded place in a district there was a terrorist conspiracy that a bomb was planted in that place and there was very less time remaining for defusing it. There was a situation that the bomb could explode and take lives of the bomb squad too. That scenario seemed irrelevant.</p>	

## 2.3 Product Development Canvas



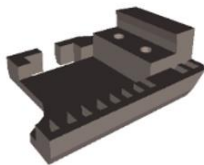
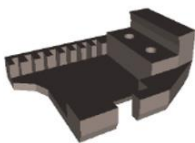
## 2.4 Ideation Canvas





## 3 IMPLEMENTATIONS

### 3.1 Conceptual Geometry







### **3.1 Cost Analysis**

Product	Quantity	Price in Rupees
Arduino Uno	1	350
MG995r Servo	5	1350
Braided fishing line	2 m	20
Black PLA	1 Kg.	4610
Servo SG90	1	120
Leap Motion	1	8000
Bolts and Nuts	-	40
Drill and Finishing kit	1	950
	<b>TOTAL</b>	<b>15440</b>

## REFERENCES

- <https://patents.google.com/patent/CN107738255A/en?q=robotic&q=hand&q=leap+motion&oq=robotic+hand+using+leap+motion>
- <https://patents.google.com/patent/CN105291084A/en?q=mechanical&q=arm&q=leap+motion&oq=mechanical+arm+using+leap+motion>
- <https://patents.google.com/patent/CN108044625B/en?q=mechanical&q=arm&q=leap+motion&oq=mechanical+arm+using+leap+motion>
- <https://patents.google.com/patent/CN109077731A/en?q=mechanical&q=arm&q=leap+motion&oq=mechanical+arm+using+leap+motion&page=1>
- <https://patents.google.com/patent/KR20170061686A/en?q=robotic&q=hand&q=motion&q=cloning&oq=robotic+hand+using+motion+cloning>
- <http://inmoov.fr/inmoov-stl-parts-viewer/?bodyparts=Right-Hand>
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- <https://youtu.be/jUkD4WNIXuk>
- [https://youtu.be/sk1NkWl\\_W2Y](https://youtu.be/sk1NkWl_W2Y)

