Prosthetic Limb with Remote Sensors

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THE HAND

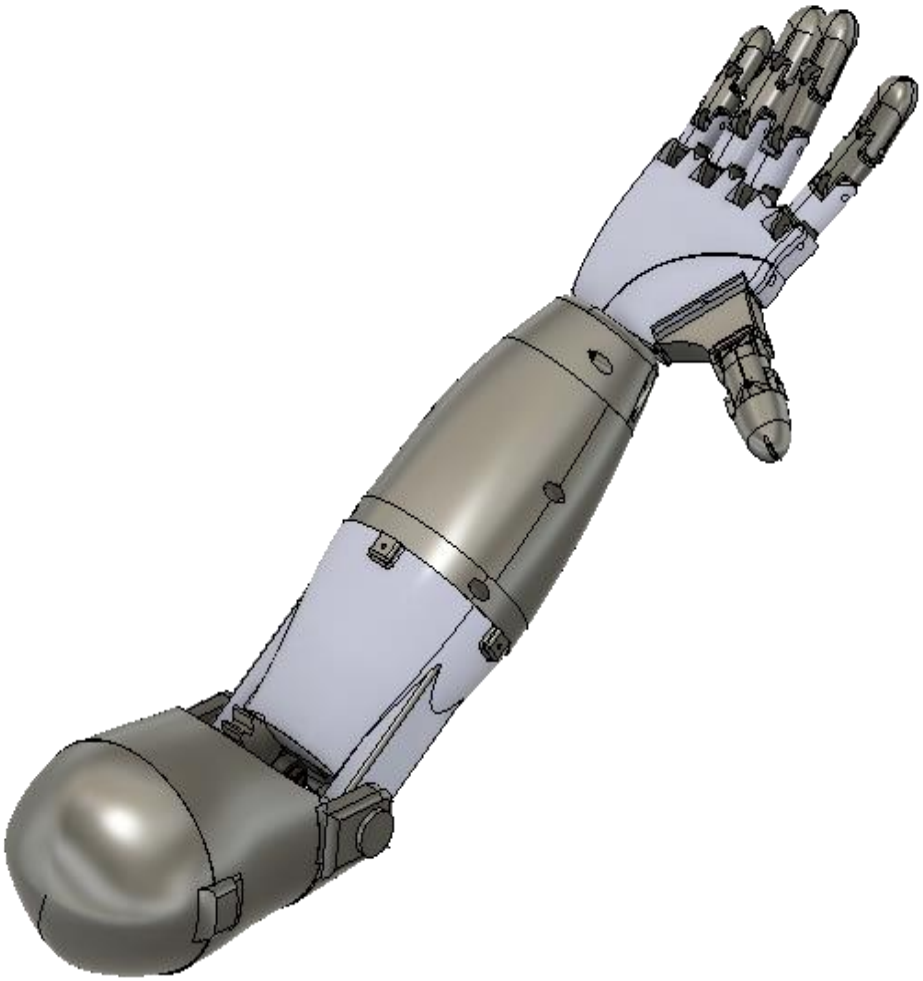


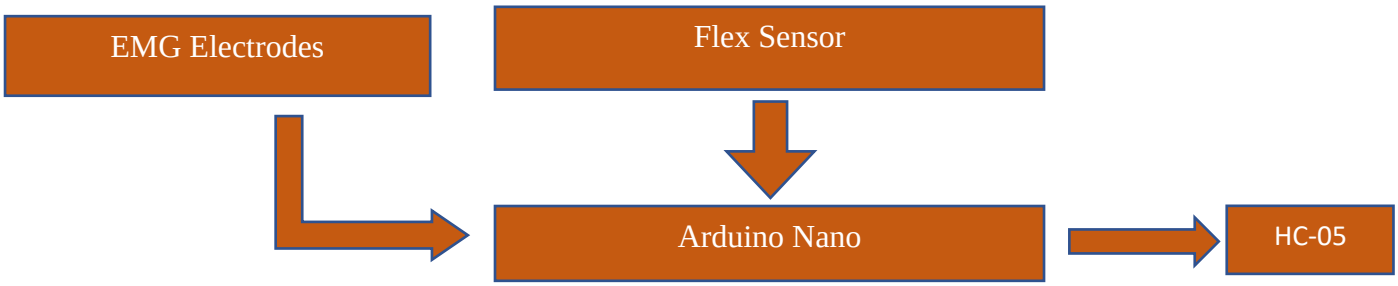
Figure 1. Proposed Prototype

Figure 2. Actual Prototype

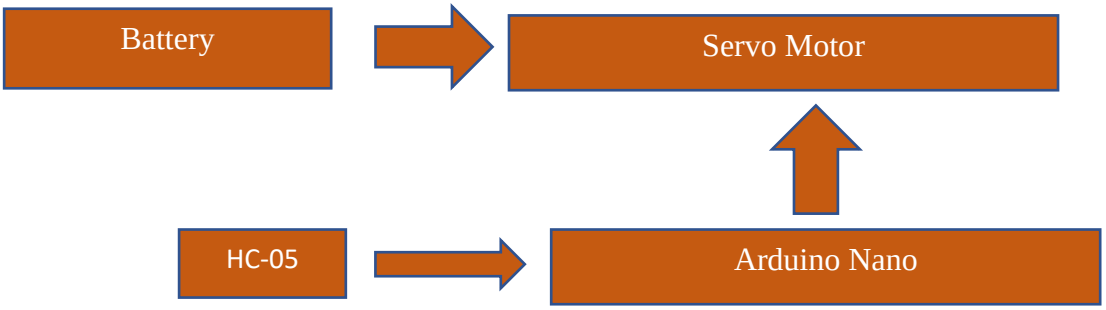
FUNCTIONING:

Prosthetic Arm:

Data Sender(MASTER):



Data Reciever(SLAVE):



On bending the fingers, the flex sensor will also bend which makes the resistive voltage drop as the resistance changes as the flex sensor bends. The voltage drop is now converted to Analog signals and sent as input to the Micro-Controller Board i.e. Arduino Nano. These values are mapped according to the need which will move the servo motor at the particular angle for the particular value of the voltage drop through Arduino Nano.These angles are send as data to hand via Bluetooth(HC-05).

The fingers of the limb are connected to the servo motors through the thread. When the Signals from the Bluetooth are received it initiates the servo which in turn produces tension on thread. Which will move the fingers of limb. When the fingers are relaxed the servo gets back to normal position making the fingers to get back to the initial position. For the elbow movement EMG electrodes are used, EMG electrodes detect the muscles movement and generates signals according to

it. Those signals are sent to Arduino Nano which are mapped further as per requirement for the movement. Those mapped values are send to receiver via Bluetooth. When receiver receives the signal it moves the servo defined as elbow. Hence via Bluetooth wireless transmission and receiving occurs which helps thehand to move with respect to the fingers bend by the user.

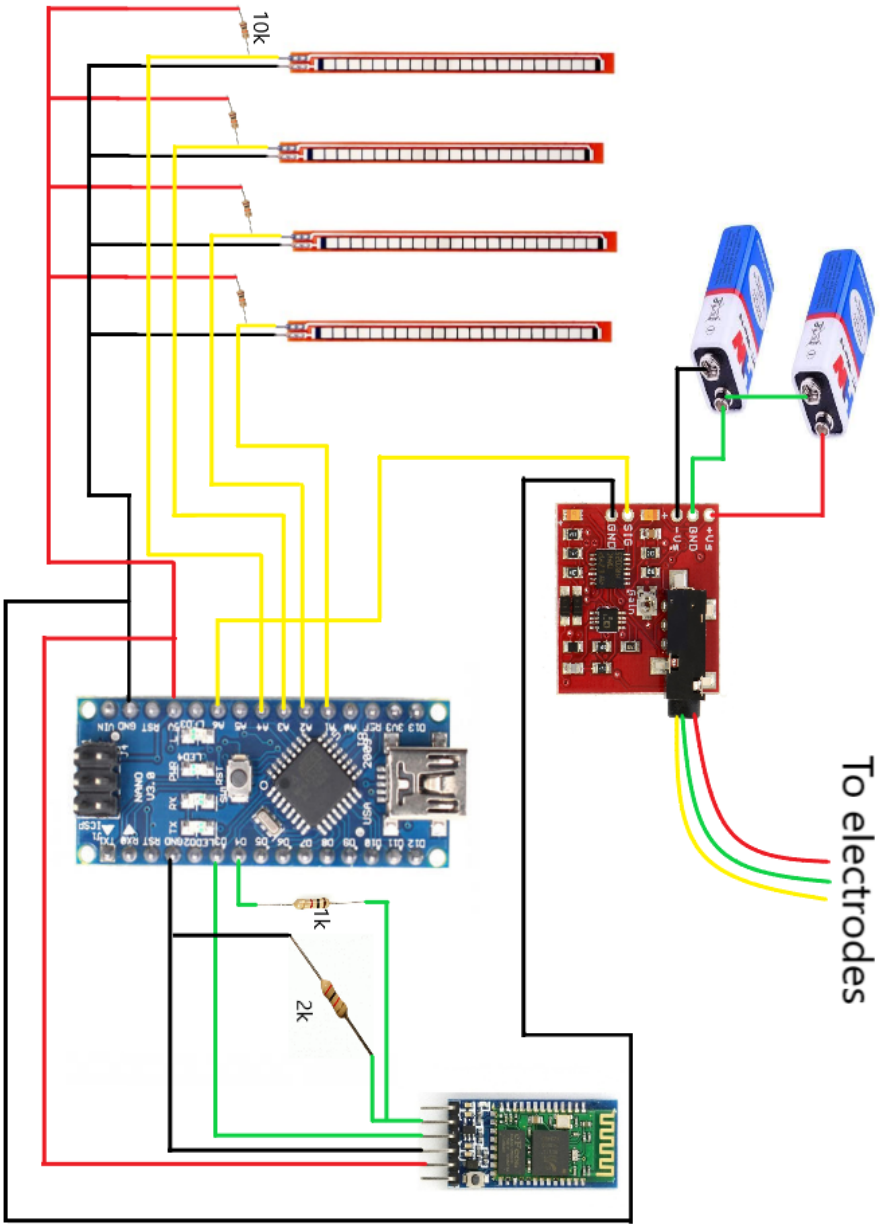


Figure 3(A). Circuit diagram for Sending Block(MASTER CIRCUIT)

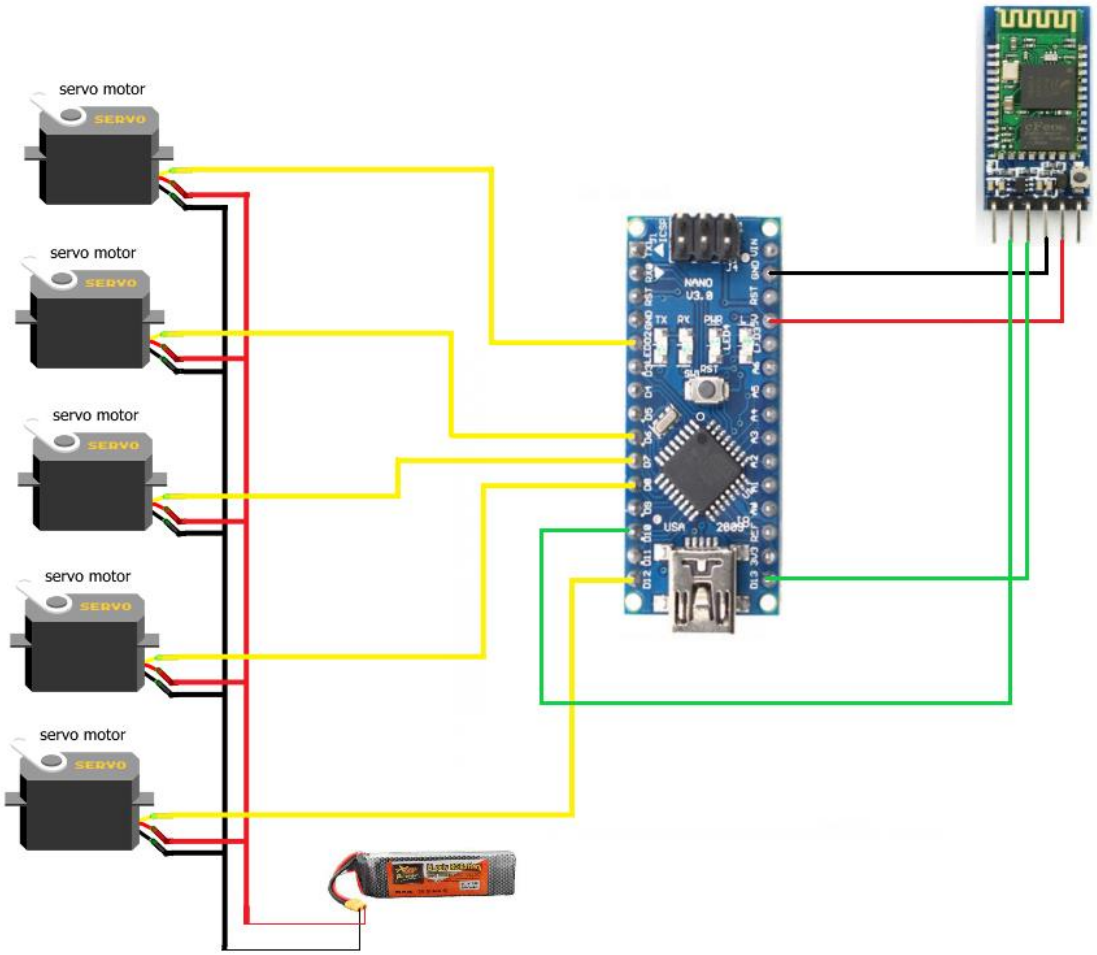


Figure 3(B): Circuit Diagram For Receiving Block(SLAVE CIRCUIT)

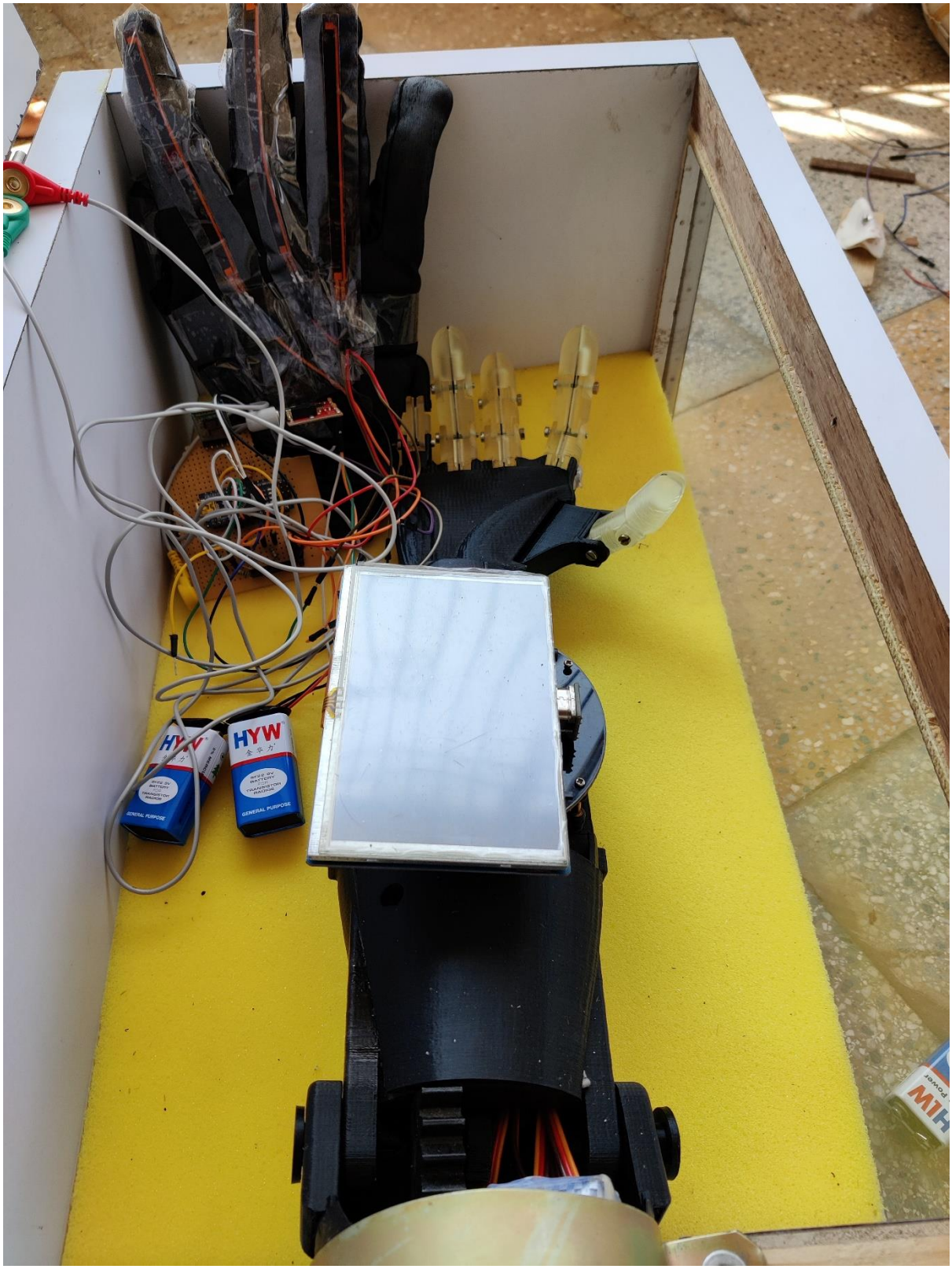


Figure 4. Hand with All the connections

IoT Based Device:

Raspberry Pi is used as the IoT device. It gets connected to home wifi and when the Local IP of the NodeMcu is entered the IOT webpage shows up. IoT webpages is shown Below.

Home Page:

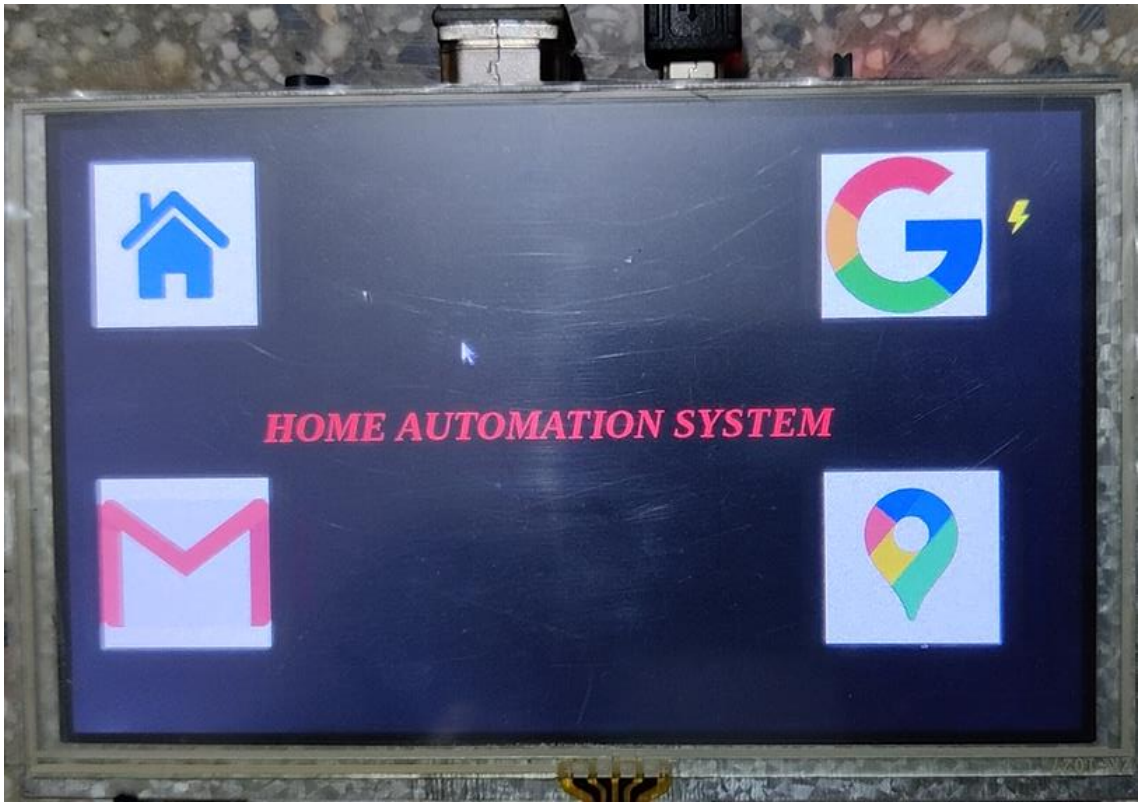
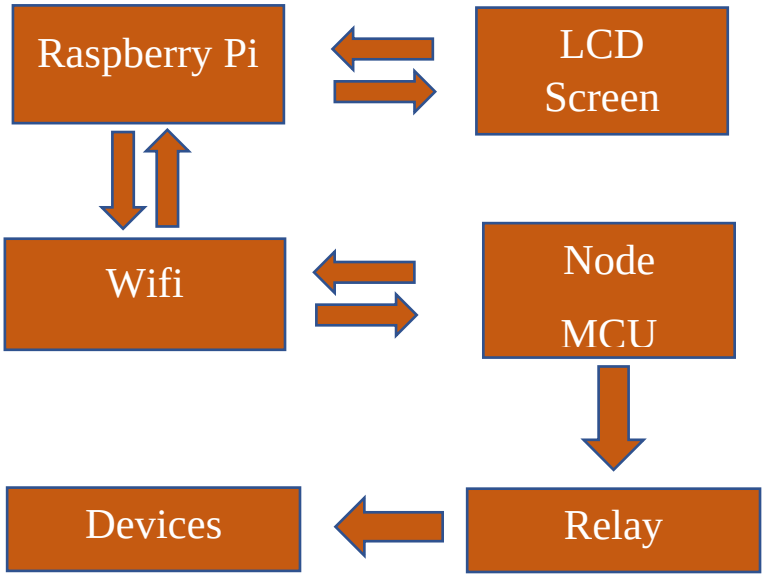


Figure 4. Home Page for IoT device.

There are options available on the home page like Maps, Google search, Gmail and Home Automation System. Figure below shows the webpage for controlling home appliances using internet.

Figure 5. Web Page

The flow chart of the operation is given below:



Each of the things are done on Raspberry Pi, we have mounted 5” LCD screen with it for controlling the device. When the Raspberry Pi gets connected to the Local Network it can access the local network IP Address generated by the the . When both gets connected we can easily switch ON/OFF anything connected to Node MCU via Raspberry Pi .

We have used Relay channel for demonstration of the Home Automation. Also we have provided Temperature and Humidity of the surrounding on the web page which continuously shows the real time Temperature and Humidity of surrounding.

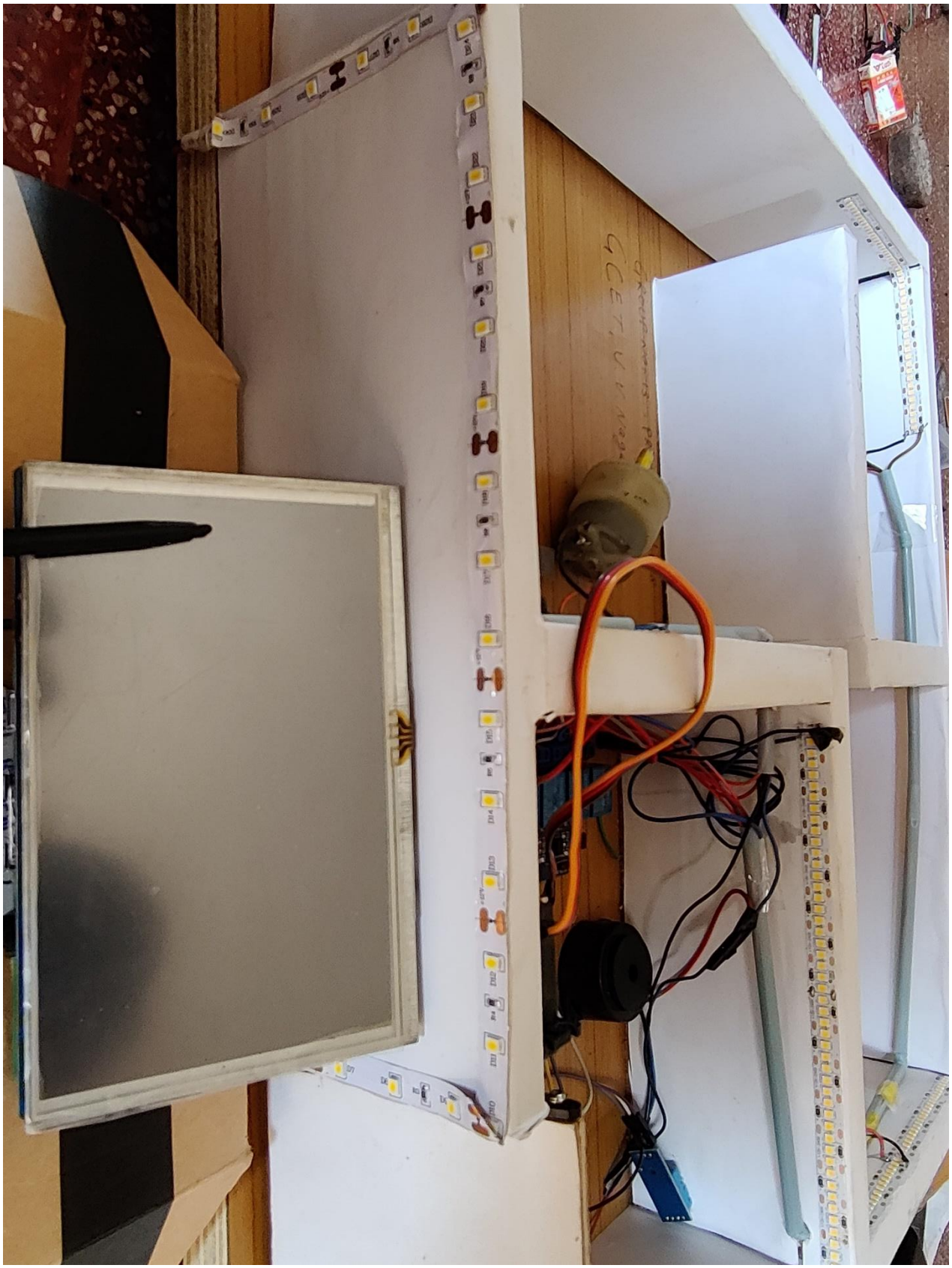


Fig 6. Model Of Home Operating via IoT Device

Fig 7. Hand With IoT device and LCD attached.

The Circuit of Node MCU and 8 channel Relay is Shown Below:

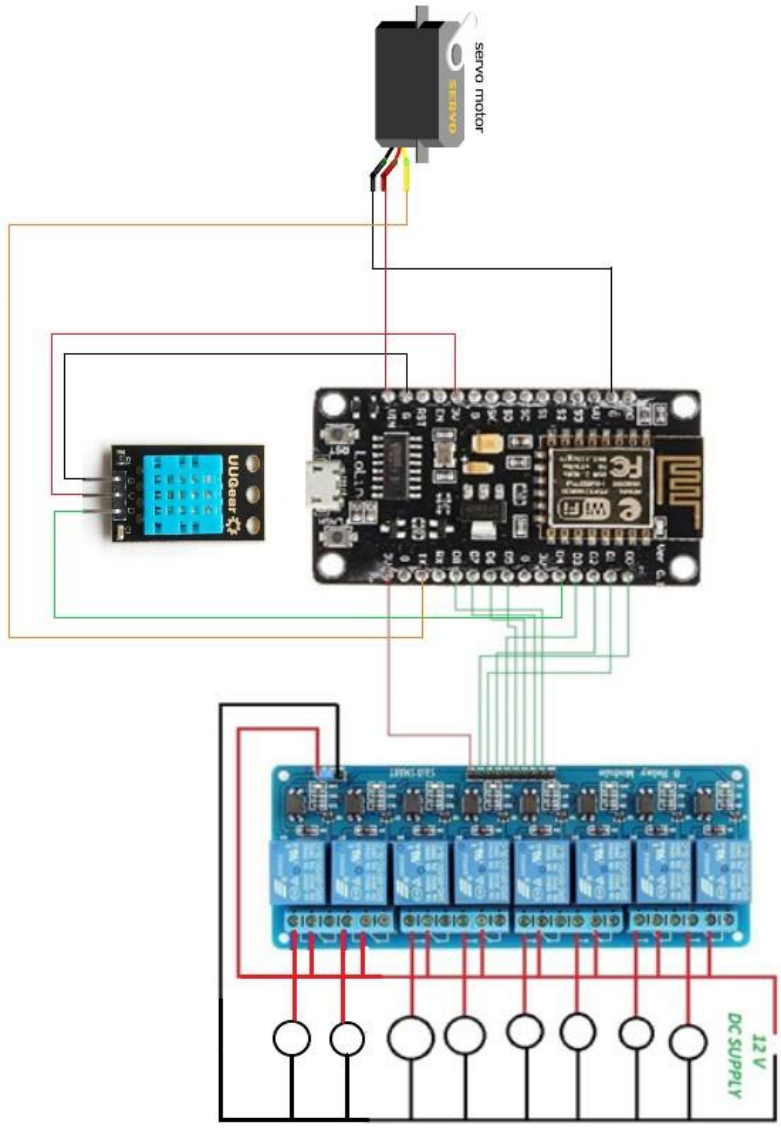


Figure 8. Connections of Node MCU and 8-Channel Relay.

MindWave.

We planned to use Brain waves(EEG waves) for controlling the arm. For fulfilment of it we decided to use NeuroSky Mindwave Mobile 2.

Figure 9. Neurosky Mindwave Mobile 2

After working on it we discovered electrical signals disturbs and affect the brain. Hence it has adverse affect on the human brain. We still continued working on it thinking once human brain will get adapted there will be no disturbance or affect but it still continued happening so we discontinued idea and switched to EEG signals. The signals captures by us can be seen in drive link sent via mail or CD drive attached with the report.

Components Used

Sr. No.	Components used	Applications
Prosthetic Limb		
1.	Flex sensors and EMG sensor	These are used to give inputs to the limb.
2.	Servo motors (12 Kg/Cm)	These motors are used in movement of the fingers in the limb.
3.	Servo Motor (60 Kg/Cm)	These motors are used in elbow movement in the limb.
4.	Arduino Nano	It is the controller of the whole circuit.
5.	Li-Po Battery	2200mAh- For controlling the arm
6.	Voltage Regulator	For converting the 12.0V supply to 7.0V
7.	Synthetic Thread	These are used to provide movement to the fingers of the limbs using servo motors
8.	Bluetooth Module(HC-05)	Used for serial communication between master circuit and slave ciruit.
9.	Load cell with HX-711	Measures the lifting weight of the hand
10.	GPB Board	Mounting circuit on the board.
11.	Resistor	10 kΩ, 2 kΩ, 1 kΩ
IoT Device		
1.	Node MCU	To provide wireless between Raspberry Pi and relays.
2.	Raspberry Pi 4B	It is used to connect the LCD screen on the limb.
3.	5” LCD Screen	It helps us to provide better user interface.
4.	8-Channel Relay	It acts as a switch.
5.	DHT11 Temperature and Humidity Sensor	It provides the input of the value of temperature and humidity.
7.	Servo Motor	It controls the movement of garage door.
8.	12V Adapter	It is the power supply of the whole IoT device.
9.	LED Strip	It is used as Light of the house
10.	DC Motor	It is used as a motor in fan.