Humanoid robot

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BONAFIDE CERTIFICATE

Certified that this project report entitled "***Humanoid robot***" is a bonafide work of **V.JACOB JEBARAJ – 18BEC1107, P.S.CHAITANYA –18BEC1172, SIVA DINESH REDDY – 18BEC1109, M.V.S.VARSHITH – 18BEC1242** who carried out the Project work under my supervision and guidance for **ECE2008 – ROBOTICS AND AUTOMATION.**

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ABSTRACT

A dream of humanoid robot researchers is to develop a complete "human-like" (whatever that means) artificial agent both in terms of body and brain. We now have seen an increasing number of humanoid robots (such as Honda's ASIMO, Aldebaran's Nao and many others). These, however, display only a limited number of cognitive skills in terms of perception, learning and decision-making. On the other hand, brain research has begun to produce computational models such as LIDA. In this paper, we propose an intermediate approach for body-brain integration in a form of a scenario-based distributed system. Busy hospital Emergency Departments (ED) are concerned with shortening the waiting times of patients, with relieving overburdened triage team physicians, nurses and medics, and with reducing the number of mistakes. Here we propose a system of cognitive robots and a supervisor, dubbed the TriageBot System that would gather both logistical and medical information, as well as take diagnostic measurements, from an incoming patient for later use by the triage team. TriageBot would also give tentative, possible diagnoses to the triage nurse, along with recommendations for non-physician care Some of the robots in the TriageBot System would be humanoid in form, but it is not necessary that all of them take this form. Advances in humanoid robotic design, in sensor technology, and in cognitive control architectures make such a system feasible, at least in principle.

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JACOB **DINESH** **CHAITANYA** **VARSHITH**

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CHAPTER 1
INTRODUCTION

A humanoid robot is a robot with its body shape built to resemble the human body. The design may be for functional purposes, such as interacting with human tools and environments, for experimental purposes, such as the study of bipedal locomotion (Bipedalism is a form of terrestrial locomotion where an organism moves by means of its two rear limbs or legs. An animal or machine that usually moves in a bipedal manner is known as a biped), or for other purposes. In general, humanoid robots have a torso, a head, two arms, and two legs, though some forms of humanoid robots may model only part of the body, for example, from the waist up. Some humanoid robots also have heads designed to replicate human facial features such as eyes and mouths. Androids (An android is a humanoid robot or synthetic organism designed to look and act like a human, especially one with a body having a flesh-like resemblance) are humanoid robots built to aesthetically resemble humans

1.1 OBJECTIVES

The following are the objectives of this project:

- Treatment of neuromuscular conditions that cause movement disabilities
- Robotic assistive technologies
- Human motor control.
- Human-like control of robots

1.2 LITERATURE SURVEY

This paper conducts a systemic literature review of a humanoid robot and summarizes all the research and studies conducted in the last ten years. The search for this review was limited to ACM Digital Library, ASME Digital Collection, BIOSIS Citation Index, CINDAS Microelectronics Packaging Material Database, Cite Seer, Computer Database, Emerald Library, Energy & Power Source, Engineering Village, IEEE Xplore, MEDLINE, OSA Publishing, PubMed, Safari Books Online, Science Direct, Sci Finder, SPIE Digital Library and Springer Database. The search was conducted using "Humanoid Robot," and all papers containing the phrase anywhere in the content were considered for further analysis. This keyword "Humanoid Robot" gave 12,261 results that included books, articles, conference proceedings, newspaper articles, dissertations, retracted papers, technical reports, audiovisuals, government documents, statistical data sets, and images.

1.4 ORGANIZATION OF THE REPORT

The remaining chapters of the project report are described as follows:

- Chapter 2 contains the laws of humanoid robot, block diagram design, standards, subdivision, hardware and software specifications of humanoid robot.
- Chapter 3 contains the Project results and inferences are described.
- Chapter 4 gives the the implementation of the project
- Chapter 5 concludes the report with discussions about the results obtained and their future implications.

CHAPTER 2

HUMANOID ROBOT- DESIGN

This chapter describes the laws of humanoid robot, block diagram design, standards, subdivision, hardware and software specifications of humanoid robot

2.1 DESIGN APPROACH

This robot is a professional small humanoid robot consist of full aluminum parts, smooth surface with smooth edges not hurting hands, the metal is unbleached, beautiful and durable.

The High Torque Standard Servo Motor with Dual Ball Bearing and Metal Gears. Provides 14kg/cm at 4.8V and 16kg/cm at 6V. Replacement for HS-645MG. Arduino Uno R3 based USB 18 Servo Controller is ideal for making Autonomous and PC based systems which run over Hobby Servo motors. The software helps to develop the complex sequences in real time on the hardware like robotic arms, walkers, bipeds and any other servo controlled system. It also generates Arduino based code for the developed sequence which can be deployed on the controller on board thereby making the robot autonomous.

Laws of Humanoid Robot:

- **Zeroth Law:** - “A Robot must not injure humanity although in action, allow humanity come to harm”.
- **First Law: -** “A Robot must not harm a human body although in action, allow one to come¬ to harm”.
- **Second Law: -** “A Robot must always obey human being, unless it is in conflict with a¬ higher order law”.
- **Third Law: -** “A Robot must protect itself from harm unless that it is conflict with a¬ higher order law”.

Humanoid robots work together in a shared space with humans. They are designed as universal helpers and should be able to learn new skills and to apply them to new, previously unknown tasks. Humanlike kinematics allows the robot to act in an environment originally designed for humans and to use the same tools as humans in a similar way. Human appearance, behavior and motions which are familiar to the user from interaction with peers make humanoid robots more predictable and increase their acceptance. Safety for the user is a critical requirement. Besides energy efficient drive technology, a lightweight design is important not only for the mobility of the system but also for the safety of the user as a heavy robot arm will probably cause more harm in case of an accident than a light and more compliant one. Due to these significant differences, much of the development knowledge and product knowledge from industrial robots cannot be applied to humanoid robots.

2.2 BLOCK DIAGRAM OF SYSTEM DESIGN

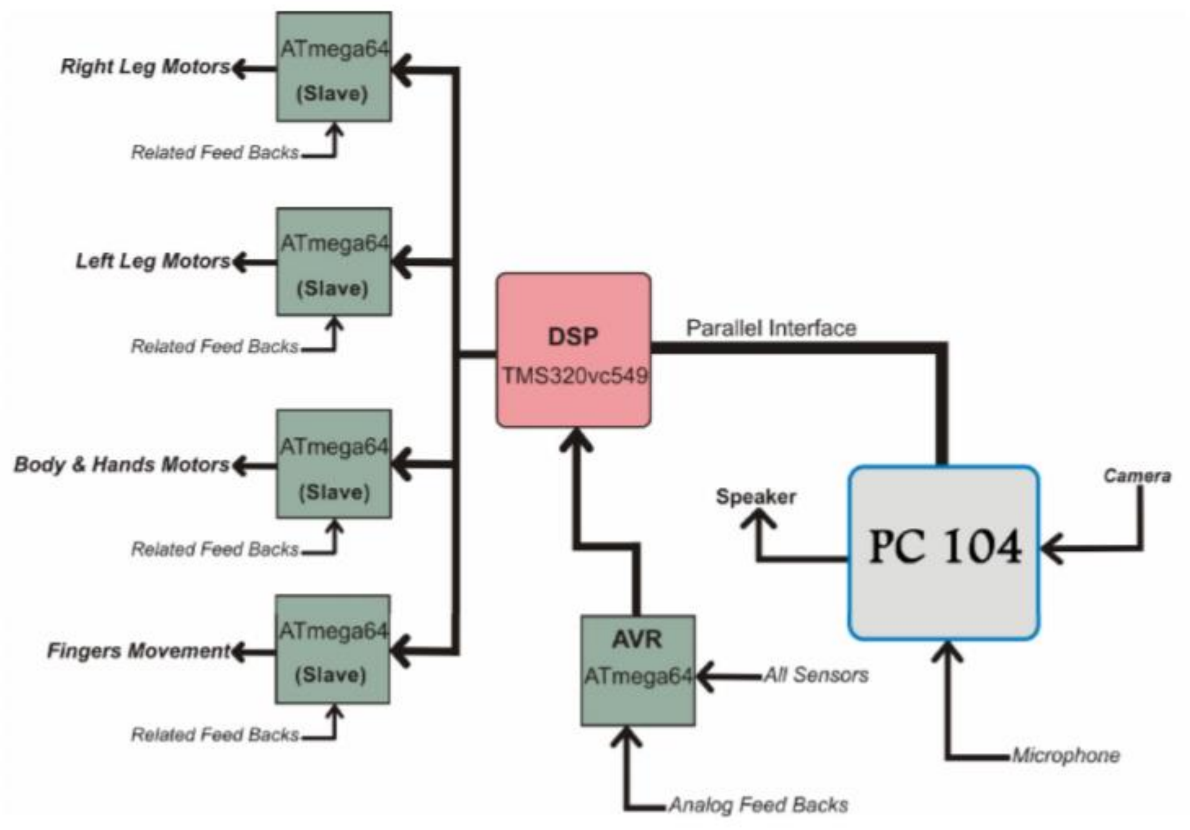
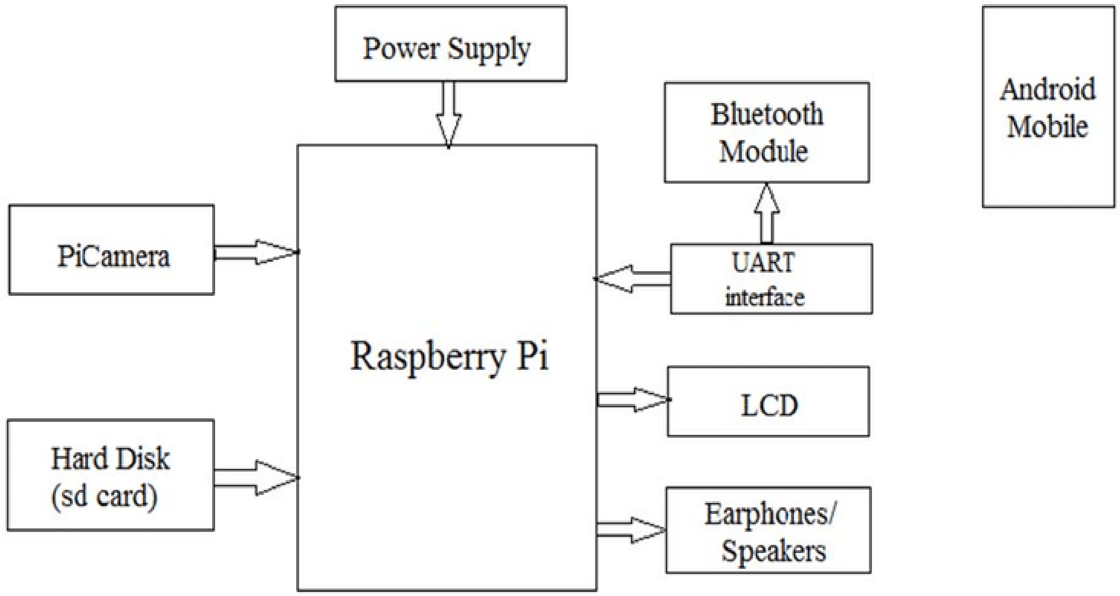


Figure 1. Block diagram shows the controller for Robots

2.2.1 BLOCK DIAGRAM OF BRAIN OF ROBOT.

Fig 2



2.3 SUBDIVISION OF THE TOTAL SYSTEM:

The development of complex systems requires a subdivision of the total system into manageable partial systems and modules. The segmentation of the total system of the humanoid robot is oriented on the interactions present in a system. The total system can be divided into several subsystems. The relations inside the subsystems are stronger compared to the interactions between these subsystems. One partial system of the humanoid robot is e.g. the upper body with the subsystem arm. The elements in the lowest level in the hierarchy of subsystems are here referred to as modules. In the humanoid robot's arm, these modules are hand-, elbow-, and shoulder joint. Under consideration of the remaining design, these modules can be exchanged with other modules that full fil the same function. The modules again consist of function units, as e.g. the actuators for one of the module's joints. The function units themselves consist of components, here regarded as the smallest elements. In the entire drive, these components are the actuator providing the drive power and the components in the drive train connected in a serial arrangement, e.g. gears, drive belt, or worm gear transferring the drive power to the joint.

2.4 HARDWARE SPECIFICATIONS

Presented architecture is provided with large level of scalability and modularity by dividing the hardware system into three basic layers. Each layer is represented as a controller centered on its own task such as external communications, motion controllers network supervision, and general control.

- Arduino Uno R3 based Bluetooth + USB 18 Servo Controller is variant of our USB servo controller for wireless applications. This device can be operated wirelessly on Bluetooth or through USB connection. This also means that it can receive signals from any devices like PCs, Laptops, Mobile phones with Bluetooth and Java, Android and windows smartphones etc. Arduino Uno R3 based Bluetooth + USB 18 Servo Controller is ideal for making Autonomous and PC based systems which run over Hobby Servo motors. The software helps to develop the complex sequences in real time on the hardware like robotic arms, walkers, bipeds and any other servo controlled system. It also generates Arduino based code for the developed sequence which can be deployed on the controller on board thereby making the robot autonomous.

- ATmega8 (used on some older board)
  Digital I/O Pins 14 (of which 3 provide PWM output)
  Analog Input Pins 6
  DC Current per I/O Pin 40 mA
  Flash Memory 8 KB
  SRAM 1 KB
- Rasperrry pi 3b
  EEPROM 512 bytesBroadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bi
  2GB, 4GB or 8GB LPDDR4-3200 SDRAM (depending on model)
  2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE.
  Gigabit Ethernet.
  USB 3.0 ports; 2 USB 2.0 ports.

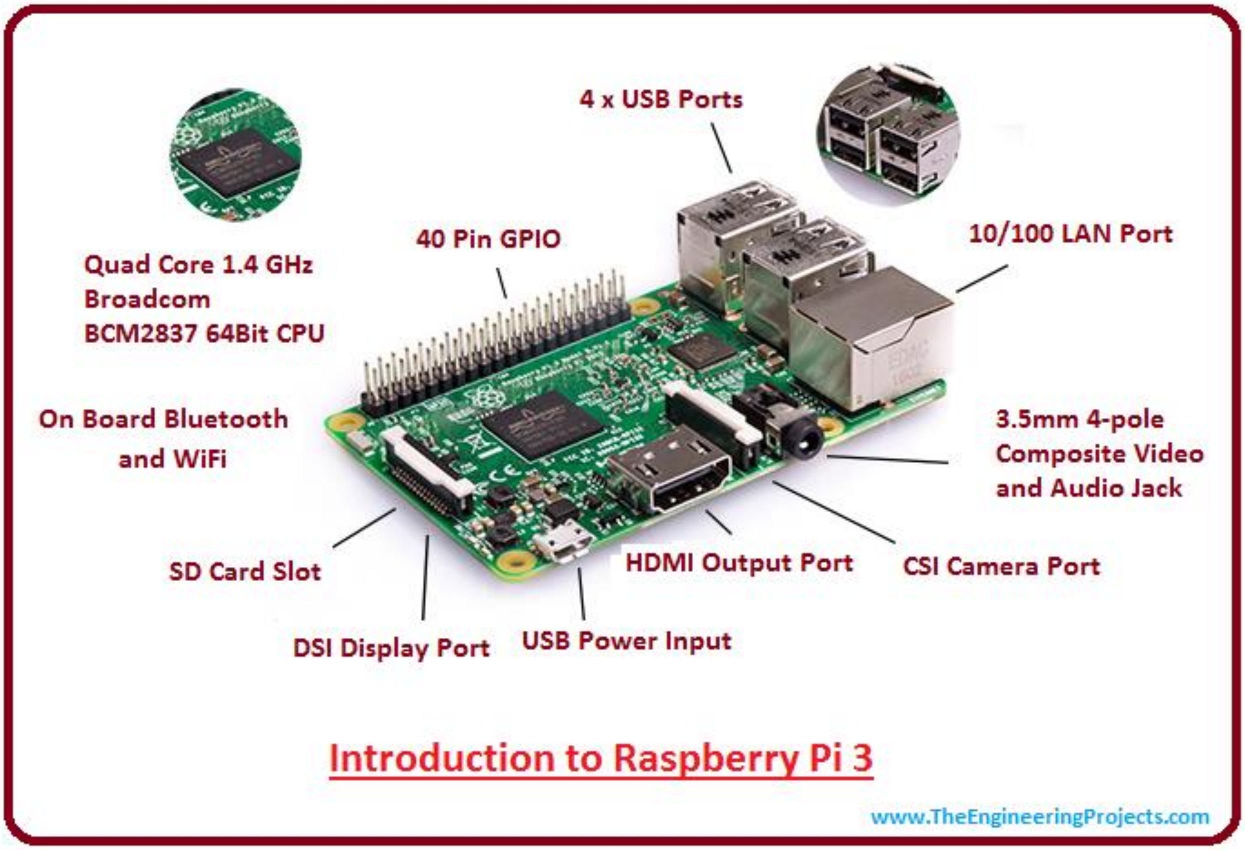
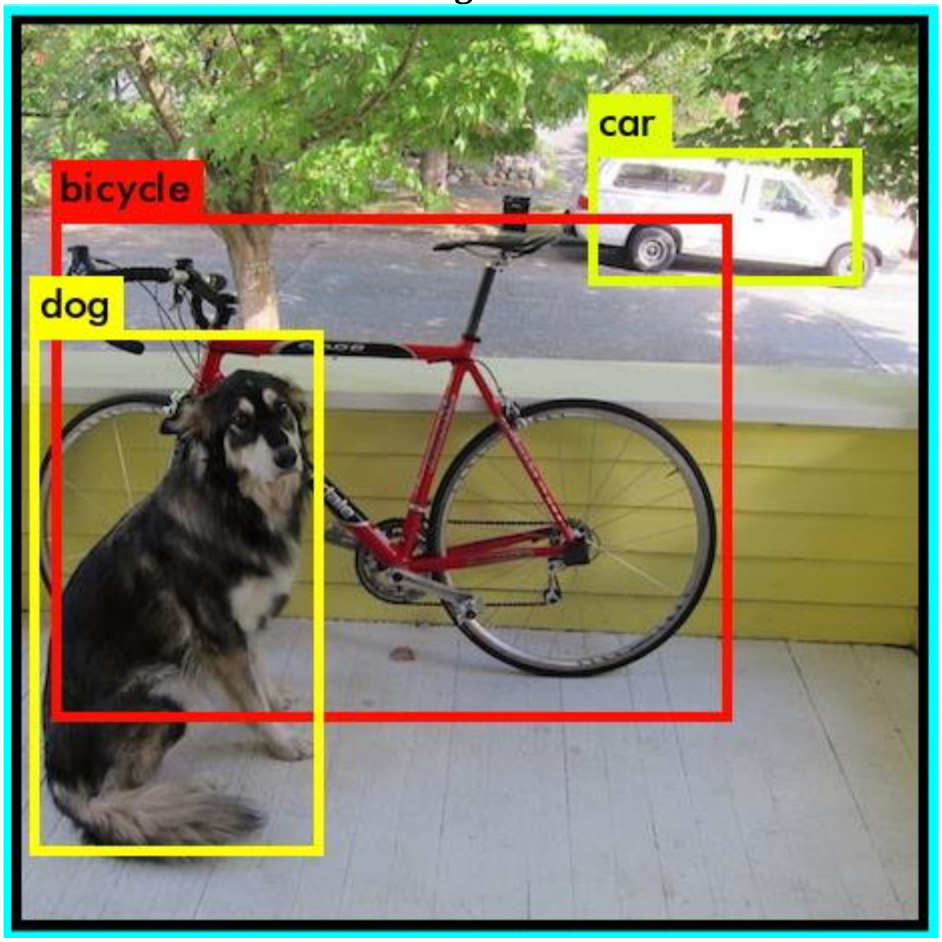


Fig 3

2.5 SOFTWARE SPECIFICATIONS

- ATMEGA CCS - C Programming
- ARTIFICIAL INTELLIGENCE
- PYTHON PROGRAMMING
- NODE RED
- MQQTT SERVER

2.5.1 TENSOR FLOW   Fig5



2.5.2 MQTT SEVER

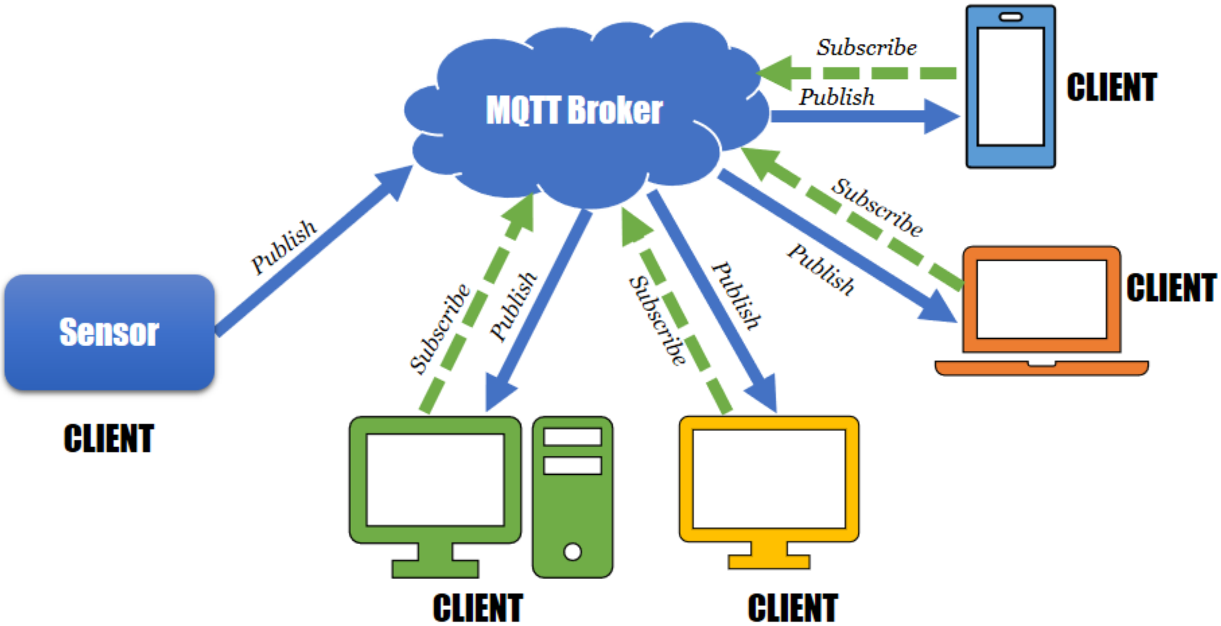


Fig6

CHAPTER 3
HUMANOID ROBOT - IMPLEMENTATION AND ANALYSIS IN MILITARY AUTOMATION

This section describes system implementation and results with inferences.

3.1 SYSTEM IMPLEMENTATION

System consist of following modules:

3.1.1 TENSOR FLOW

TensorFlow allows developers to create *dataflow graphs*—structures that describe how data moves through a graph, or a series of processing nodes. Each node in the graph represents a mathematical operation, and each connection or edge between nodes is a multidimensional data array, or *tensor*.

TensorFlow provides all of this for the programmer by way of the Python language. Python is easy to learn and work with, and provides convenient ways to express how high-level abstractions can be coupled together. Nodes and tensors in TensorFlow are Python objects, and TensorFlow applications are themselves Python applications.

The actual math operations, however, are not performed in Python. The libraries of transformations that are available through TensorFlow are written as high-performance C++ binaries. Python just directs traffic between the pieces, and provides high-level programming abstractions to hook them together.

TensorFlow applications can be run on most any target that's convenient: a local machine, a cluster in the cloud, iOS and Android devices, CPUs or GPUs. If you use Google's own cloud, you can run TensorFlow on Google's custom TensorFlow Processing Unit (TPU) silicon for further acceleration. The resulting models created by TensorFlow, though, can be deployed on most any device where they will be used to serve predictions.

TensorFlow 2.0, released in October 2019, revamped the framework in many ways based on user feedback, to make it easier to work with (e.g., by using the relatively simple Keras API for model training) and more performant. Distributed training is easier to run thanks to a new API, and support for TensorFlow Lite makes it possible to deploy models on a greater variety of platforms. However, code written for earlier versions of TensorFlow must be rewritten—sometimes only slightly, sometimes significantly—to take maximum advantage of new TensorFlow 2.0 features.

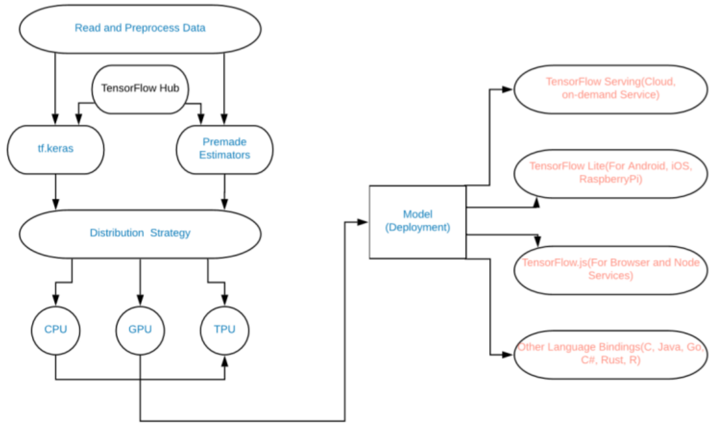


Figure 7. WORK FLOW(TENSOR FLOW

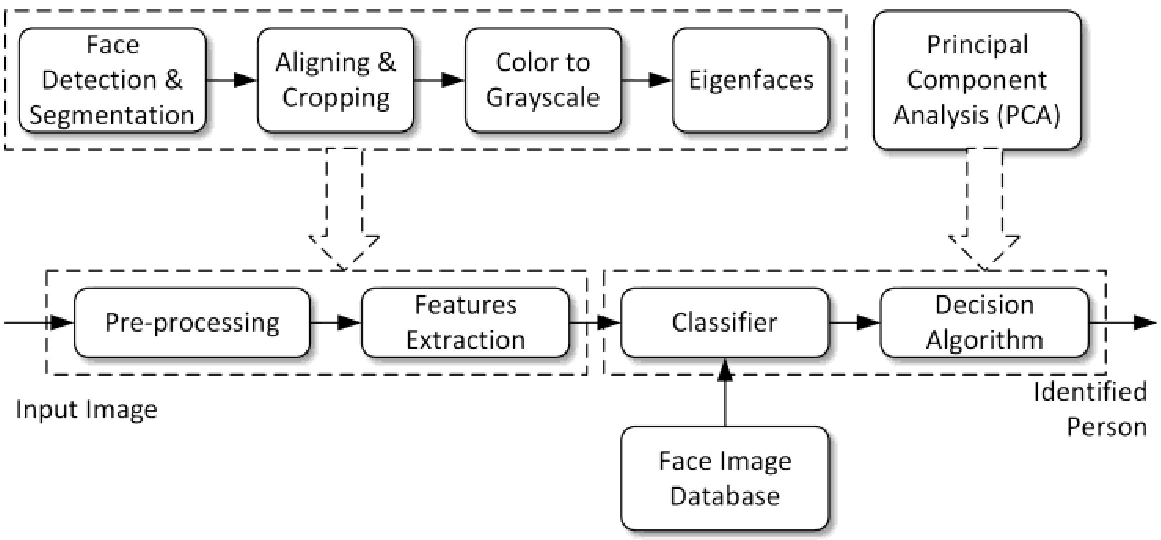
3.1.2 FACE DETECTION CODE

```
# OpenCV program to detect face in real time
# import libraries of python OpenCV
# where its functionality resides
import cv2

# load the required trained XML classifiers
# https://github.com/Itseez/opencv/blob/master/
# data/haarcascades/haarcascade_frontalface_default.xml
# Trained XML classifiers describes some features of some
# object we want to detect a cascade function is trained
# from a lot of positive(faces) and negative(non-faces)
# images.
face_cascade = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')

# https://github.com/Itseez/opencv/blob/master
# /data/haarcascades/haarcascade_eye.xml
# Trained XML file for detecting eyes
eye_cascade = cv2.CascadeClassifier('haarcascade_eye.xml')
```

```
# capture frames from a camera
cap = cv2.VideoCapture(0)

# loop runs if capturing has been initialized.
while 1:

    # reads frames from a camera
    ret, img = cap.read()

    # convert to gray scale of each frames
    gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

    # Detects faces of different sizes in the input image
    faces = face_cascade.detectMultiScale(gray, 1.3, 5)

    for (x,y,w,h) in faces:
        # To draw a rectangle in a face
        cv2.rectangle(img,(x,y),(x+w,y+h),(255,255,0),2)
        roi_gray = gray[y:y+h, x:x+w]
        roi_color = img[y:y+h, x:x+w]

        # Detects eyes of different sizes in the input image
        eyes = eye_cascade.detectMultiScale(roi_gray)

        #To draw a rectangle in eyes
        for (ex,ey,ew,eh) in eyes:
            cv2.rectangle(roi_color,(ex,ey),(ex+ew,ey+eh),(0,127,255),2)

    # Display an image in a window
    cv2.imshow('img',img)

    # Wait for Esc key to stop
    k = cv2.waitKey(30) & 0xff
```

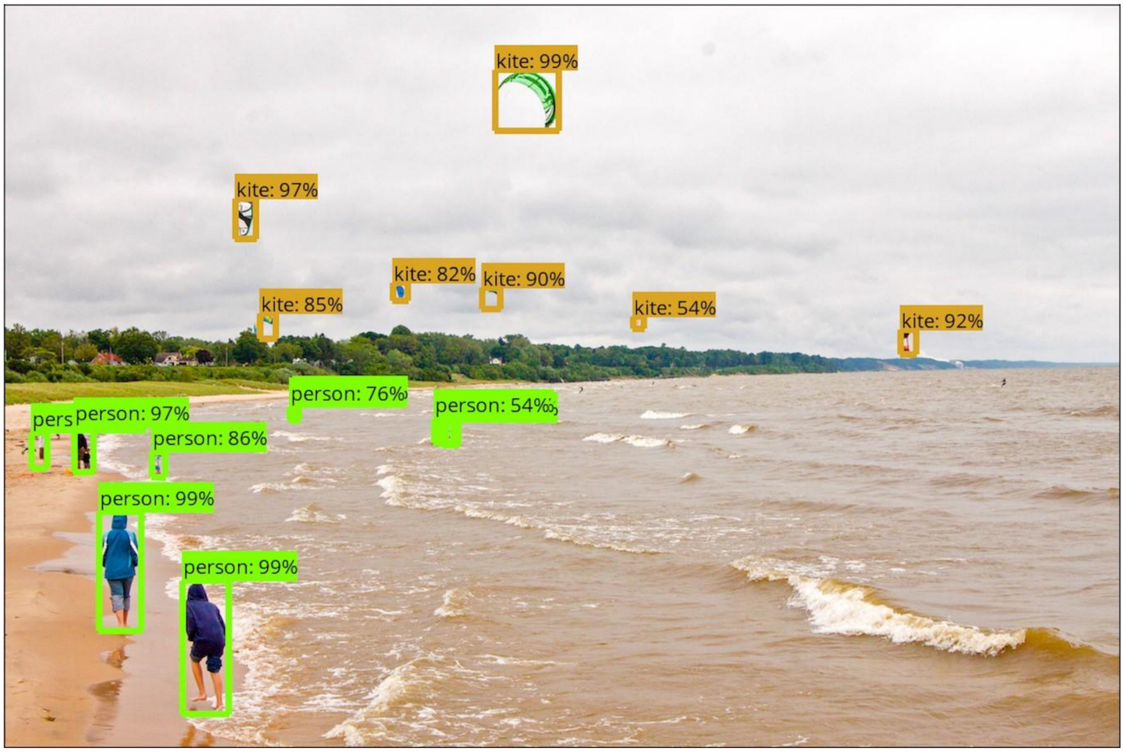
```
        if k == 27:
            break

# Close the window
cap.release()

# De-allocate any associated memory usage
cv2.destroyAllWindows()
```

Figure 8 FACE DETECTION diagram



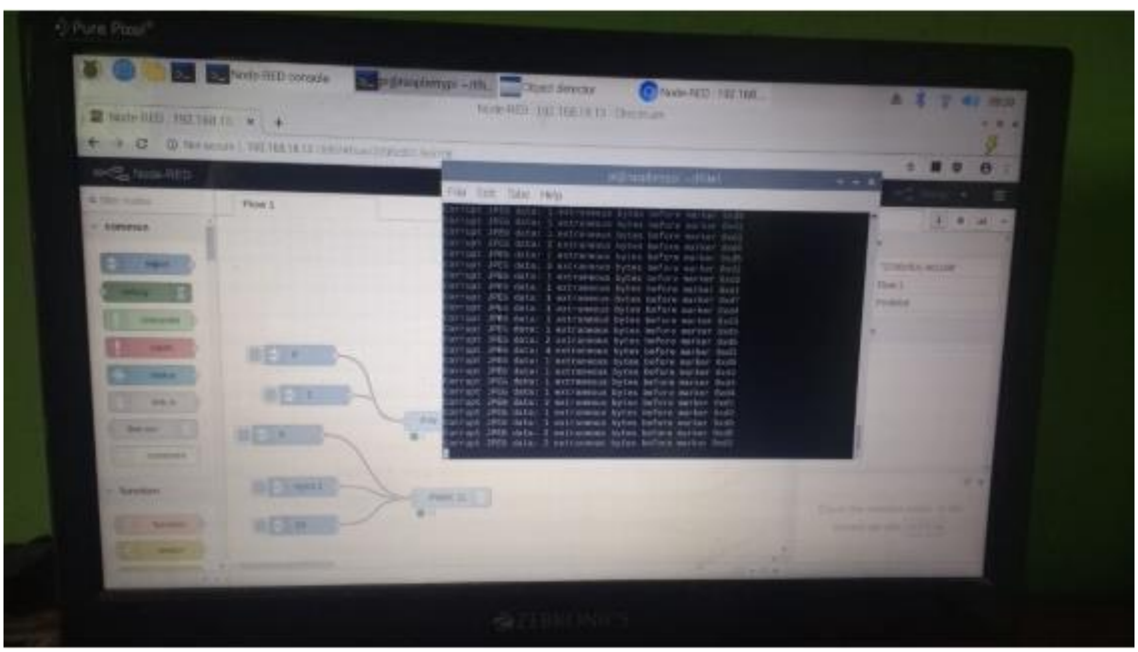
3.1.3 SENSOR READINGS

The end nodes were able to transmit the values collected from the sensors to the Raspberry Pi, as shown in figure 9



TENSOR FLOW OUTPUT

<u>NODE RED FLOW FOR TORCH AND SERVOS</u>



NODERED FLOW FOR TENSOR FLOW MODEL

:

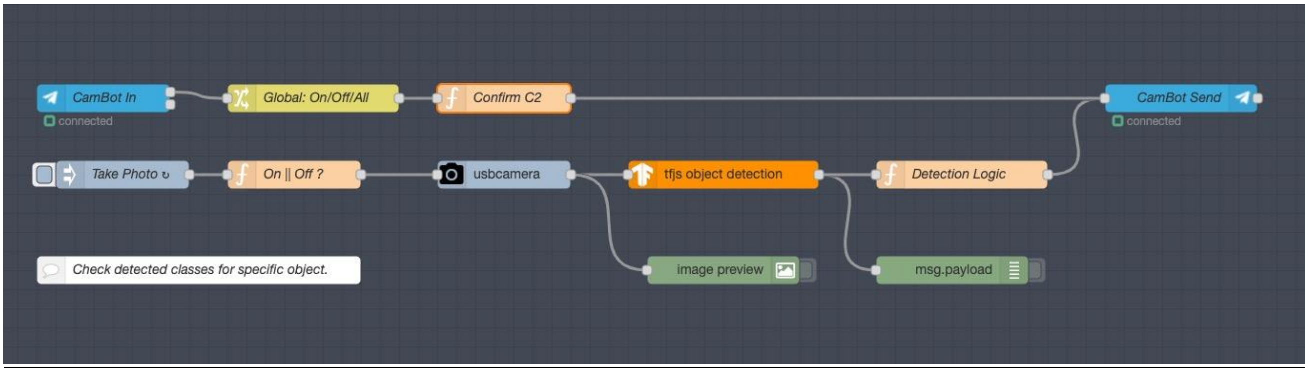
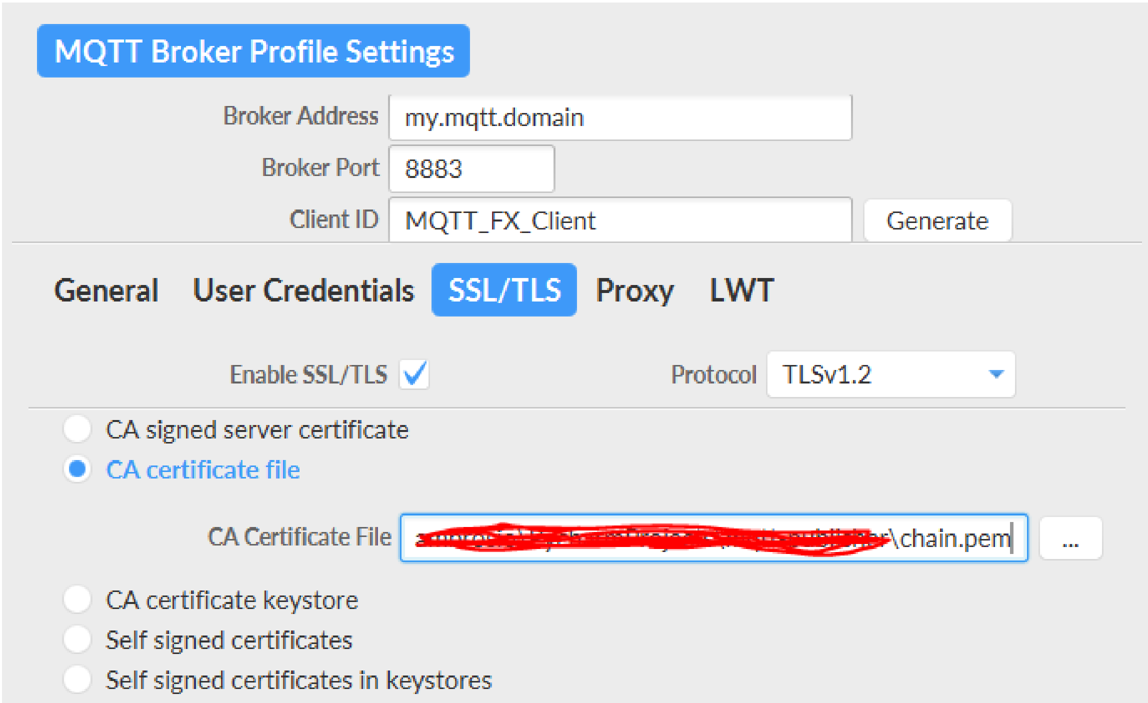
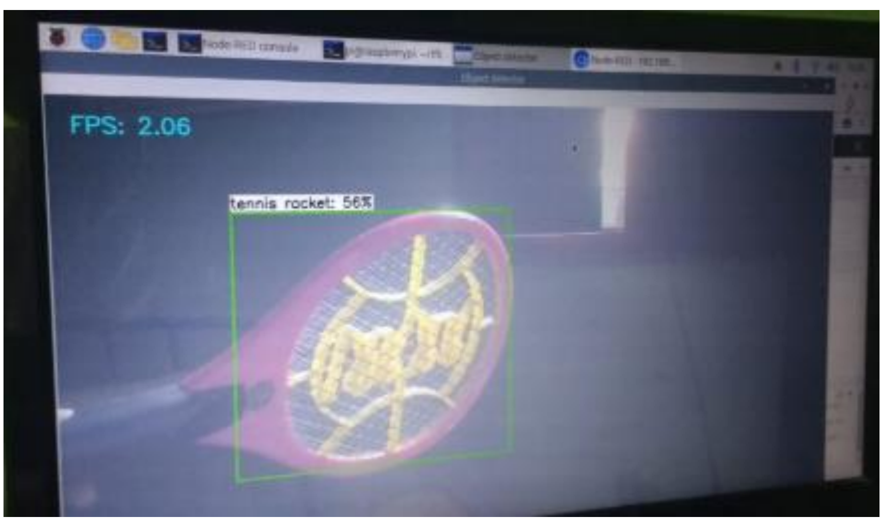


FIG:Values collected from sensors

3.1.4 INTEGRATION OF PYTHON AND ROBOT USING MQTTSERVER



THIS ROBOT CAN DETECT FACE IF ANY TERRORIST FACE DETECTED IT WILL SHOOT AND INFORM TO MILITARY



Website login page

3.2 RESULTS AND INFERENCES

Figure 7 the overall implementation of sensors data acquisition and communicating to coordinator. The coordinator node

Sensed Data and Communication to Coordinator

https://www.youtube.com/watch?v=a2zlvmFxWoo

CODE ANALYSIS

- **Number of Lines: 194**
- **Number of Functions/Routines: 15**

CHAPTER 4

COMPONENTS

4.1 List of components

The various components used in this project are given below in Table

List of components

COMPONENTS
Arduino Uno R3 based Bluetooth + USB 18 Servo Controller
Lithium Polymer (Li-Po) Rechargeable Battery 7.4V 1500mAH 20C
Multipurpose Aluminum Standard Servo Bracket
Short U Shape Aluminum Servo Bracket
Long U Aluminum Servo Bracket
Ultrasonic sensor
Robot feet Aluminum Servo Bracket Methane sensor Mq4 sensor
Miniature Ball Radial Bearing
Metal Horn for Servo 25T
Screw and screw cap set
Oblique U Shape Aluminum Servo Bracket
Interconnect Aluminum Servo Bracket
L Shaped Interconnect Servo Bracket
Large U Beam Aluminum Servo Bracket Rasberry pi 3 b Camera module Humidity sensor

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 CONCLUSION

In this project we have designed a humanoid robot by servo motor as its main motion provider & lithium polymer battery as its main source of power. Aluminum sheets have been used as a building block or body of the robot.

The designed robot is purposed for the assistance & to follow orders as per the instructions given to it. The Instruction of walking, turning has been programmed by the help of arduino programming language which is to be saved in the arduino circuits to perform the action of the robots as ordered.

It follows order on commands, Ultrasonic sensor are connected & installed in it for sensing obstructions in the path while walking & then diverting its path to avoid that obstructions.

This project shows the spectacular functions of a robot its credibility & efficiency. Robotics is everything in the coming future, a robot can perform all the functions effectively and efficiently as per command given to them, their speed & strength makes them more reliable & efficient then the human hands. It has no mind of its own so the robot only follows order by this way it can be considered as human most faithful friend.

In this project our humanoid robot has been designed to follow commands, when we command it to walk, it starts walking & only stops when it command to do so. We have installed some sensors in it to sense various obstructions & threats. These robots can be used as assistance for performing various hard & tough labors which are a bit unenviable for humans they are currently being used in various big industries & factories to perform various task which are a bit tough for the human force, they can perform all the heavy task without taking much time & without doing any mistakes & causing any delay, & we can have all our work under precision by their assistance all we have to do is to command it & it will perform all the functions

5.2 FUTURE WORK

Robotics has a very crucial & wide scope in the future as the technology is kissing advancement every single moment to make our life better & more comfortable. Robotics is the present & future of science, a humanoid robot have their own importance because they are design to perform all the task of a human being but in a more precise manner they can perform the task which are nearly impossible for human hands or their strength & speed enables them to perform the task of 10 to 12 humans single handedly & that's why their bodies are design on the basis of a shape of a human body

5.3APPLICATIONS OF HUMANOID ROBOT

Nowadays, robots in the military are an alternative to human soldiers. These robots are being designed to handle a broader range of combat tasks, from picking off snipers to carrying out target acquisition with greater efficiency as compared to human soldiers. They can be deployed in situations and areas which are dangerous and can kill or maim troops. Army robots can provide a backup during heavy artillery fire and reduce the number of casualties. They can also map a potentially large hostile area by accurately detecting a variety of threats.

Military robots come in different shapes and sizes depending on the requirement, and they may be remotely controlled or fully autonomous. Robots consist of different types of payloads depending on the application. Depending on the application requirements, sensors, detectors, weapons, programmed software, and other payloads can be equipped on robots used in the military.

Militaries are focusing increasingly on the development of various new robot technologies that can be helpful for armies in case of war. For example, the Defense Advanced Research Projects Agency (DARPA) is financing a robotic submarine system that could be used intelligently for several applications ranging from detecting underwater mines, engaging in anti-submarine operations, and protecting ships in harbors.

FIELD WORK:

FIG:MAKING ROBOT TO WALK ON ROUGH SURFACE

FIG:ASKING MILITARY PERSONS FOR MORE DETAILS IN SOCIAL MEDIA AND CODING

CHAPTER 6

REFERENCES

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[2] Collette, C., Micaelli, A., Andriot, C. & Lemerle, P. (2007) ‘Dynamic balance control of humanoids for multiple grasps and non-coplanar frictional contacts’, ‘Humanoid Robots’, 2007 7th IEEE-RAS International Conference.

[3] http://robokits.co.in/, homepage of Robokits India, Gandhinagar, India

[4] https://www.arduino.cc/, hompage of Arduino.

[5] The Future of Humanoid Robots – Research and Applications Edited by Riadh Zaier Published by In-Tech Janeza Trdine 9, 51000 Rijeka, Croatia.

GITHUB FOLDER CODES AND SOURCES

TENSORFLOW: https://github.com/tensorflow/models

FACEDETCTION: https://github.com/ageitgey/face_recognition

BIODATA

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