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MULTI SENSOR DATA FUSION BASED PARALLEL MANIPULATOR WITH IOT MONITORING EMPLOYING MACHINE LEARNING

S.Shreyanth, V.Abilash, K.Prudhvi Kumar,

Anna University,Chennai,India

ABSTRACT

A simple robotic parallel manipulator is implemented employing embedded systems integrated with set of sensors more than one type of sensor is implemented together the control input data from a human limb. Initially a data set is collected on map to certain equivalent actuations at the manipulator and then using an appropriate machine learning algorithm the control data value for continuous position of actuator is generated.

A substantial amount of work is done on mapping the position of the limb to to the actuator position by creating a three dimensional model conventional 3D conversion is used on the boundary values of the input and output of matched with certain level of intermediate values a proper training dataset for a machine learning algorithm can be created.

The position of the manipulator is monitored by an iot system a set of sensor installed at the end and Applied Sciences And transmits The Possession date of the equator is this information can be viewed remotely from any device connected to the internet.

Key Words : Flex Sensor, Robotic Gripper, Actuator, Parallel Manipulator, Computational Neural Network(CNN), Linear Regression.

INTRODUCTION

Robotics an interdisciplinary branch of engineering and science that includes mechanical engineering, electronic engineering, information engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing

These technologies are used to develop machines that can substitute for humans and replicate human actions. Robots can be used in many situations and for lots of purposes, but today many are used in dangerous environments (including bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space). Robots can take on any form but some are made to resemble humans in appearance. This is said to help in the

acceptance of a robot in certain replicative behaviors usually performed by people. Such robots attempt to replicate walking, lifting, speech recognition, and basically anything a human can do. Many of today's robots are inspired by nature, contributing to the field of bio-inspired robotics.

The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Throughout history, it has been frequently assumed by various scholars, inventors, engineers, and technicians that robots will one day be able to mimic human behavior and manage tasks in a human-like fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots are built to do jobs that are hazardous to people such as defusing bombs, finding survivors in unstable ruins, and exploring mines and shipwrecks. Robotics is also used in STEM (science, technology, engineering, and mathematics) as a teaching aid. The advent of nanorobots, microscopic nanotechnology and bioengineering.

OBJECTIVE

To design and implement parallel manipulation using multi sensor data fusion for improved accuracy employing machine learning algorithm for suitable actuator sensor data mapping.

The basic idea is involved around making a robotic gripper controllable via IOT server.

PROBLEM DEFINITION

Early, huge cables and button type remote controls were used to control the robots, but these were not sufficient to fulfil the complex needs of the daily requirements of the society. In order to overcome this problem, we are introducing a gesture controlled robots, that is a hybrid combination of various domains. This gesture controlled robot will enhance the future of the human real life and complex operation like deploying a grenade based land mines and more, which will reduce the risk of human life. This can make a great revolution in medical field as well.

EXISTING SYSTEM

Earlier, huge cables and button type remote controls were used to control the robots,but these were not sufficient to fulfil the complex needs of the daily requirements of the society.

DRAWBACKS OF THE EXISTING SYSTEM

Huge cables and button type remote controls used in robots for controlling. The major drawback is that, it has less operating range and accuracy issues, which may drastically change the behaviour of the robot.

PROPOSED SYSTEM

A parallel manipulator robotic gripper is actuated employing the hand gesture motion. When the hand is closed as a fist, the gripper closes, hence gripping the object by task. Similarly, when the hand opens, the gripper also opens releasing the object by task. A glove incorporated with the sensor is worn by the person controlling the robotic gripper. The sensors used are flux sensors. Flux sensors take constant current into them and when fluxed, the resistance changes. The change in resistance causes a change in voltage. The change in voltage is measured as output of the sensor. Since the flux sensor is an analog sensor, the fluctuation is very high in its output. A simple linear mapping machine learning approach is employed to initially map the flux sensor output to the motor input. Averaging of consecutive output values of the flux sensor is done for reducing the erroneous output values that happen due to fluctuation. This process of calibrating the flux sensor output is very efficient method instead of employing a hardware solution in which a low pass filter is used.

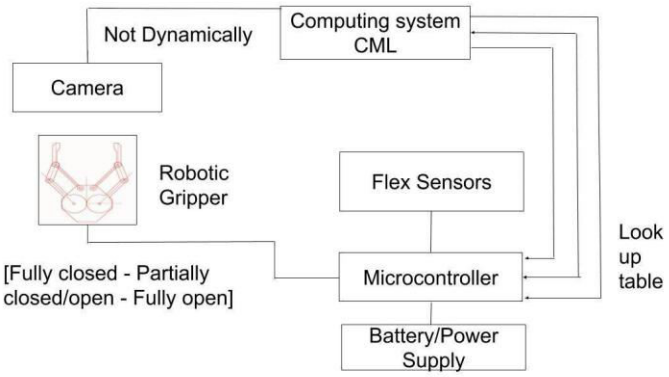
The open or the close position of the gripper is identified by a camera with an integrated image processing computing system. The computing system has the trained machine learning model of CNN (Computational Neural Network) which detects if the robotic gripper is closed or open. Once the position of the gripper is identified by the machine vision system, the information is passed on to an integrated IoT system, which uploads the current position of the gripper in the internet.

ADVANTAGES OF PROPOSED SYSTEM

By using multiple data sensors and supporting hardware setup, an enhanced accuracy is achieved by artificial intelligence.

To control the robot in huge operating range, enable the Iot systems to control the robot from long distances using image processing techniques.

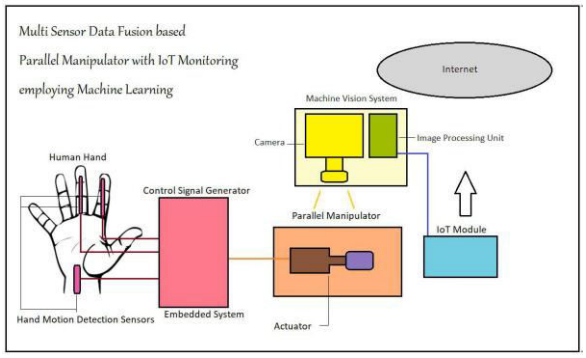
HARDWARE IMPLEMENTATION



Hardware implementation of the parallel manipulation is carried out by collecting the flex sensor signals from glove which is attached to hand trained AI, capable of choosing better signal from flex. A control signal is generated simultaneously to run the

actuation unit. ML based technique called LINEAR REGRESSION is used to map the sensor signals and accurate actuation. Then the actuation unit is monitored by image processing and output is transferred to server based internet of thing.

PROJECT IMPLEMENTATION

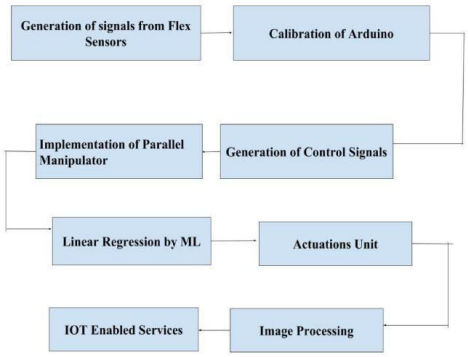


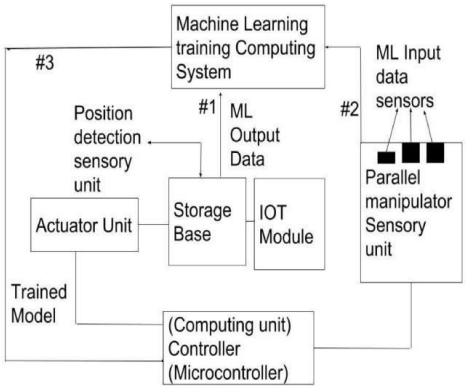
A simple robotic parallel manipulator is implemented employing embedded systems integrated with set of sensors more than one type of sensor is implemented together to control input data from the human limb. Initially, a data set is collected on map to certain equivalent actuations at the manipulator and then using an appropriate machine learning algorithm to control data values for continuous position of actuator generation.

A substantial amount of work is done on mapping the position of the limb to the actuator position by creating a three-dimensional model in conventional 3D conversion that is used on the boundary values of the input and output is matched with certain level of intermediate values of properly trained dataset for a machine learning algorithm can be created.

The position of the manipulator is monitored by an Iot system, a set of sensors installed at the end and Applied Sciences transmit the Possession data of the equator. Hence, this information can be viewed remotely from any device connected to the internet of the same server base.

FLOW DIAGRAM AND ALGORITHM





Initially, the signals are captured from the limbs as input and these signals are generated directly by the flux sensors that is attached along with the limbs. The flux sensors capture the mechanical motion to transform it as electrical signals. These signals are calibrated in the Arduino, Where the signal possess unique configuration based on the analog and digital pins connected to motor driver. The signals passed from the arduino are in the form of control signals which can be easily accessible to the actuator. The actuators are invoked in the parallel manipulator that helps in the movement of actuators along with alternate signal generation. Once as the signals are collected from the parallel manipulator, they are plotted under a particular machine learning process, using linear regression that allows neural language processing, once after the system is positioned it is ready for the actuation to perform with in the computing unit. The system is now ready for its output and the replicate of the output is stored directly into the server based IOT domain. The capturing of the images are processed by a camera that sends the data as the status of the output, which is further initiated by image processing technology.

OUTPUT

Robotic Gripper output when the input flex sensor signals are generated.

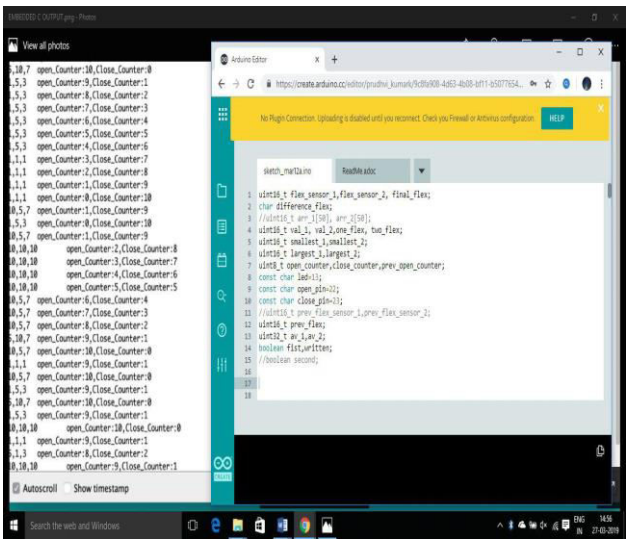


Image processing output stored in the IOT module when the Robotic Gripper is open along with the machine learning system.

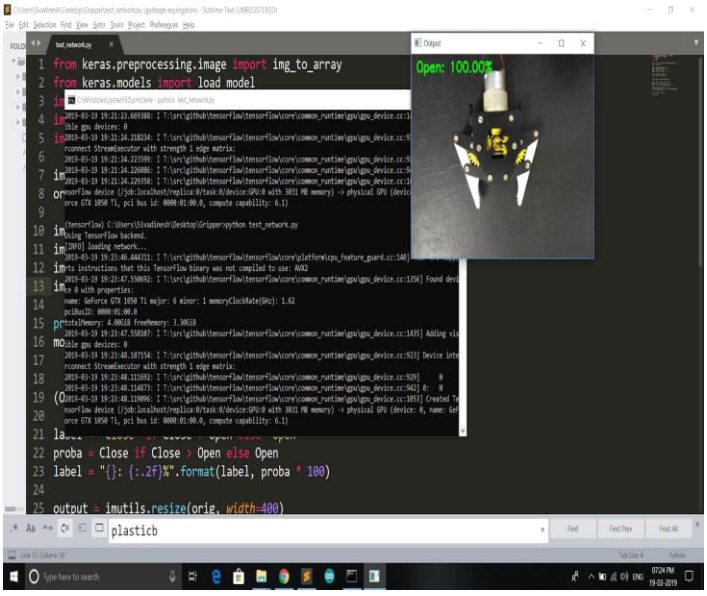
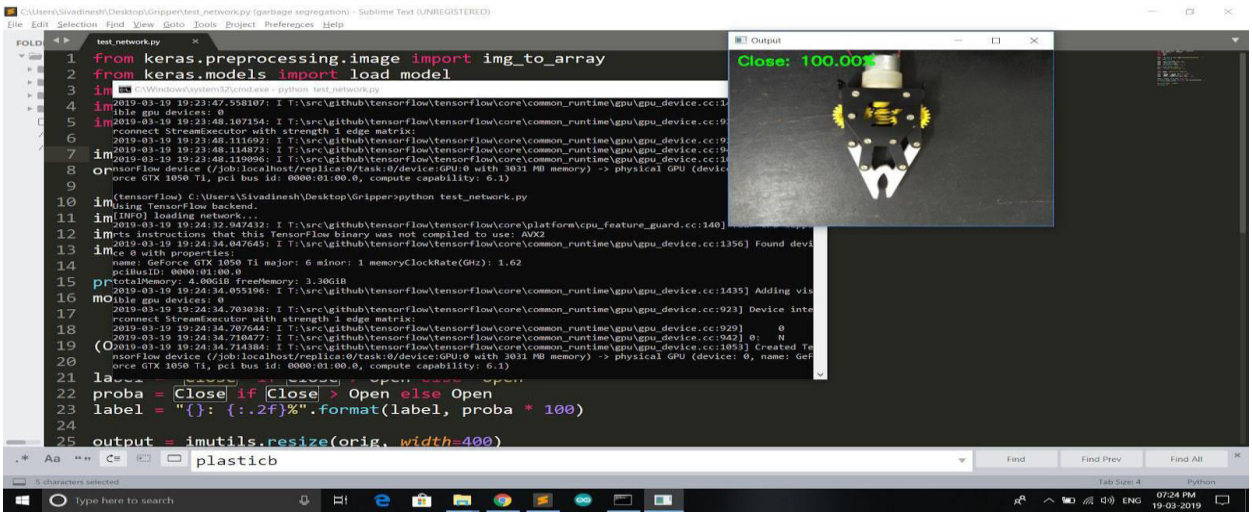
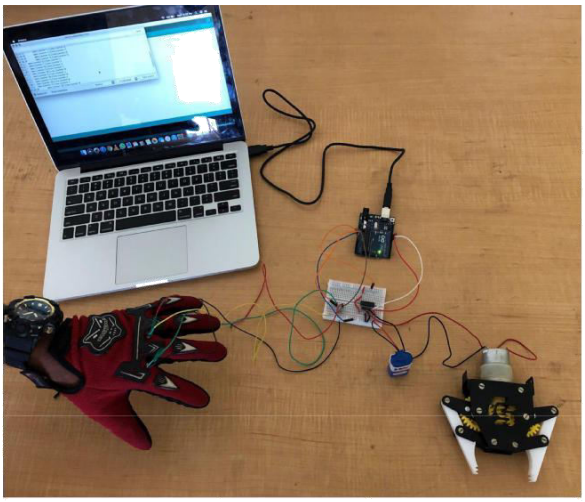


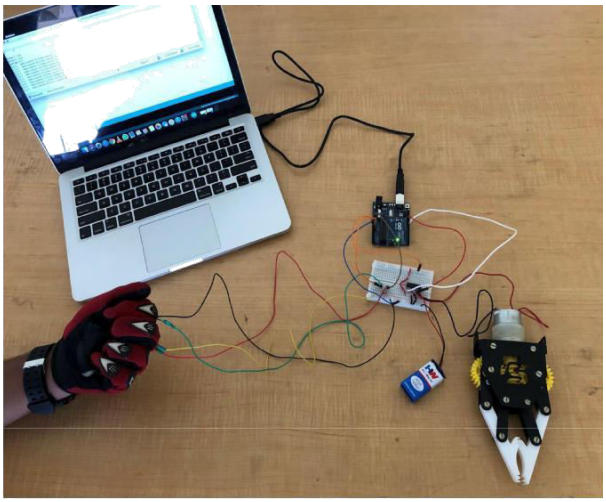
Image processing output stored in the IOT module when the Robotic

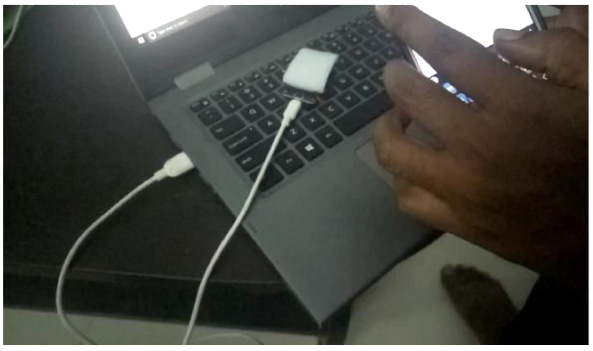
Gripper is closed along with the machine learning system.

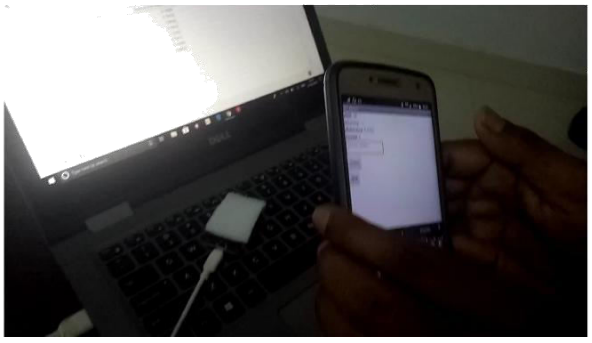


5.4 Hardware Representation









CONCLUSION

The earlier proposed system of the robotic domain was based on automated control of electronic system. Since these depend on the electronic system that are purely based on the generation of indefinite signals, an improper accuracy rate is generated that require indefinite time elapse. To overcome this, the gesture method is introduced so the signals are generated directly from the mechanical motion to electrical signals as input. These can improve accuracy with constant time interval that do not create any overlapping of signals. The gesture-controlled robots are monitored by machine learning algorithm so that the movements of the actuator are plotted graphically under linear regression. This is helpful to determine any minor mistakes or obscure in the position of the system. These output signals generated are collected and stored in the server-based internet of things that can be accessed with in a particular range. Implementing the image processing methodology helps to determine the status of the output.

FUTURE WORK

Huge amount of work can be contributed in the field of robotics, especially it must be designed in a way that it uses wireless technology in full fledged manner. Machine Learning and Artificial Intelligence are domains contributing a lot to the field of robotics with the help of python and embedded codes, this technology must be implemented to increase the accuracy of the sensing and actuation units. i.e., more computer neural works must be computed in order to achieve high accuracy in the actuation unit. Hardware Implementation can be further developed by using robotic arm, limb, wrist based movements, in spite of its expensiveness.

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