JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

METAL DETECTION BY DRONE FOR SURVEILLANCE USING ACTUATORS

S. Dinesh Tharun[1] and P. Siva Kumar[2]
[1,2]Department of Electronics and Communication Engineering,
[1,2]Dr. N.G.P. Institute of Technology Coimbatore, Tamil Nadu, India
dineshtharun1100@gmail.com[1]

Received: 14 Feb 2020 Revised and Accepted: 25 March 2020

ABSTRACT: This article offers the assessment via drone for surveillance and bomb diffusion through actuators. The recommended approach comprises of less in weight, easily carried and customer pleasant with dimished convolution. The innovative glove network is a wi-fi and self-contained machine that's established at the customer arm in an effort to regulate the motion of the robot. Thus the machine provides high security for the existence of the bomb diffusion squad. The proposed device is noticeably useful in the all regions that call for safety and it presents virtual fact in surveillance and diffusion.

Key Words: bomb detection; bomb diffusion; high security; virtual fact

I. INTRODUCTION

A bomb squad observing network needs high number of soldiers that are located to disperse a bomb and rescue human lives. The wifi violent tool disposal robot that will assist to increase safety. The robot that is going to make will have both command and control action. This robot receives command as control signal from customers and does the necessary action. It provides a permitable distance to dispose the bomb.Commonly, the bomb squad have both metal identifiers as well as gadget. But, the squad has to come nearer to the location without any precautions and protection.The proposed robotic offers an additional layer of protection to the squad by permitting them to see and investigate a doubtful packet before the start of clearance. A robot took danger out of relatively issues and the bomb experts attention on what to do to an explosive equipment rather than at the instantaneous opportunity to survival and limb.

II. LITERATURE REVIEW

Identification of buried landmines is a risky part of humanitarian demining (HD) because it usually entails human deminers appearing risky responsibilities in the area . Isolating metal components of buried unsafe targets from normal metal clutter is a completely tough and time consuming task [8] Gesture is viewed as a chain of progressive postures that are action of the fingers, the information from the hand and a further value that shows the re-habitability of the posture and its value [12] The structured haptic interface is a lightweight, transportable, and independent mechatronic gadget that fits on an uncovered hand and offers haptic power remarks to each finger of the hand without compelling their movement [2] The metallic detector circuit is located on a robot automobile and its operation is to detect on metals underneath automatically[10] It is monotonus for humans to concurrently have a look at every kind of event on numerous cameras[9] It can delegate for dubious bomb location and destruction, danger identification and so forth. That is really unsafe for officer inside the war field or fringe security region [4] A form of small robotic packages now emerging where robots are employed to finish an assortment of errands. By and large, robots are nevertheless utilized for hazardous work that is dangerous for humans [13].

III. THEORETICAL INFRASTRUCTURE

The model appeared underneath includes 2 segments for example transmitter end and recipient end. The transmitter end involves a couple of gloves and Arduino UNO that inputs the encoded motions from the sensors . The recipient end have msp430 controller that includes an automated arm situated on a robot that is controlled by means of the decoded signals from the client.

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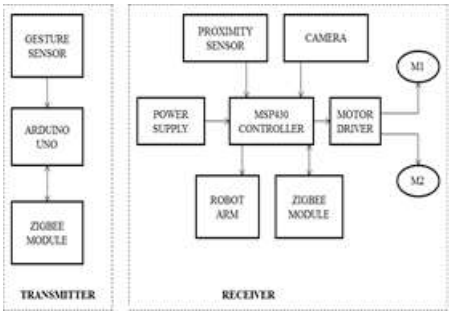

Fig 1: Block diagram

TRANSMITTER END

a)GESTURE SENSOR:

APDS-9930 sensor measures light, gestures and distance. Gesture detection adopts 4 directional photodiodes to sense reflected IR energy to change physical motion data to a digital data. The gesture engine furnishes a comprehensive variety of mobile equipment gesturing necessity. Power consumption and noise are downsized with flexible IR LED timing.

b)ARDUINO UNO:

Arduino UNO is an ATmega328P based microcontroller. It contains 16MHz quartz precious stone. Its working voltage is 5V consolidating a blaze memory of 32kB and SRAM of 2kB. This controller is embraced at the transmitter side from where the information in bundles is sent to the collector end.

c) ZIGBEE MODULE :

The zigbee module act as both transmitter and receiver. The Zigbee module is used to send commands from the user end and actuate the robot accordingly with the help of a motor driver. And as per the commands received, it drives the motors by sending signals to the motor driver

RECEIVER END:

a)MSP430 CONTROLLER:

MSP430 is a microcontroller portfolio which gives exceptional varieties of 16-bit Microcontrollers. These microcontrollers integrated with extremely-low energy, virtual and analog peripherals gadgets for sensing and dimension applications.MSP430 has a characteristic of 16-bit registers consistent generators which affords maximum code performance.

b) MOTOR DRIVER (L293D):
L293D IC is a regular Motor Driver IC which lets in the DC motor to drive on any route. This IC consists of 16-pins which might be used to control a set of 2 DC motors right now in any route.

c) SERVO MOTOR:

A servo motor proceeds along linearly for managing and object in rotational direction. For shifting network servomotor can be used.. On a given direction, it rotates as a good deal needed and then look forward to the coming sign to be taken for likewise action.

d) PROXIMITY SENSOR:

Inductive vicinity sensor is a non-contact electronic nearness sensor. It is embraced for situating and recognizable proof of metallic devices. The sensor is a gadget that utilizes the guideline of electromagnetic enlistment to find or measure objects. This effect can be utilized to distinguish metal articles that connect with an attractive field.

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IV. FLOW CHART

The figure 2 appeared beneath is explained how the robot is made to arrange the bomb which is the major instrument. Applications are shown in this task to diffuse the bomb and if the bomb is un diffusible than take it to the protected area with the assistance of the lifting gripper that is situated in the robot.

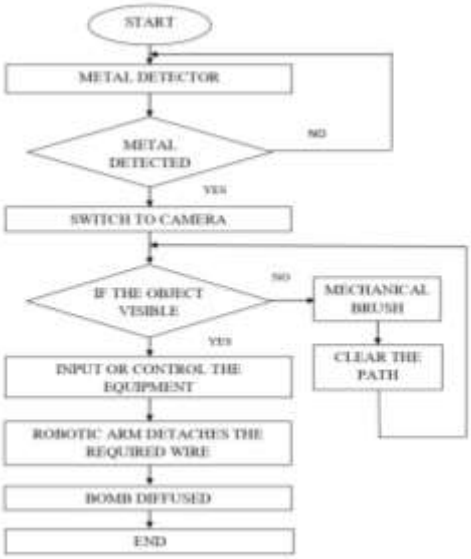

Fig 2 : Flow Chart

V. HARDWARE IMPLEMENTATION

a)METAL DETECTOR:

i)Operation of proximity sensors:

A proximity sensor identifies the methodology of an object without creating a contact and the categories are high-frequency oscillation, Magnetic and Electrostatic capacity type.

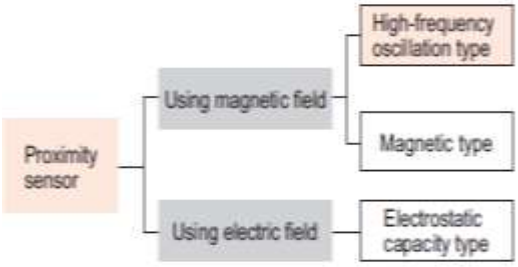

Fig.3 : Operation of proximity sensors

ii)High frequency oscillation:

Detection coil generates an extreme-frequency magnetic field as proven in the figure beneath. When a metallic produces magnetic field, inductive currents flow in the metal and so inflict thermal loss and result in stopping of oscillations.

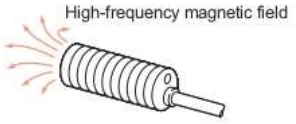

Fig 4: High frequency Magnetic Field

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Eddy currents produces thermal loss as the resistance of the steel lowers the magnitude of oscillation.

Fig 5: Eddy current

iii) Standard sensing object:

A sensing object that serves as a reference for estimating complete performance and this is made of accurate materials and has a specific shape and dimensions.

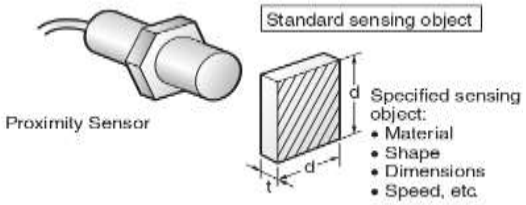

Fig 6: Standard sensing Object

iv)Sensing Distance:

The distance from the reference position to the measured function whilst the similar old sensing object is shifted through the specified approach

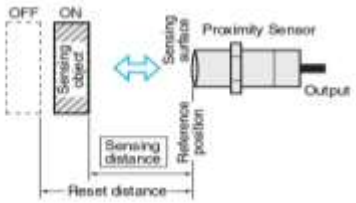

Fig 7: Sensing Distance

v)Set Distance :

The distance from the reference surface that permits strong usage in addition with the outcomes of temperature and voltage to the sensing object transit role. This is about 70% to eighty% of the usual (rated) sensing distance.

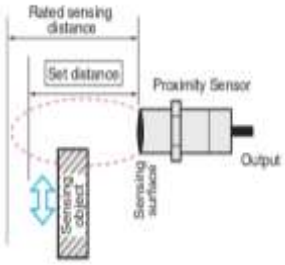

Fig 8:Set Distance

vi)Hysteresis :

Regarding the separation between the typical detecting object and the Sensor, the contrast between the space at which the Sensor capacities and the hole at which the Sensor resets.

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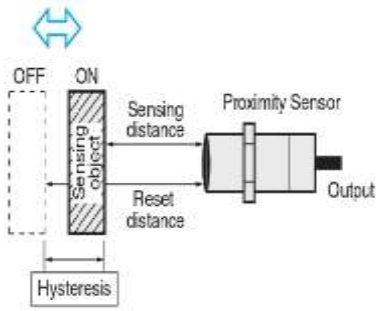

Fig 9:Hysteresis

vii) Response Time:

The language interval from the factor when the normal sensing objects actions into the sensing location and the Sensor stimulates to the point when the output turns ON and OFF respectively.

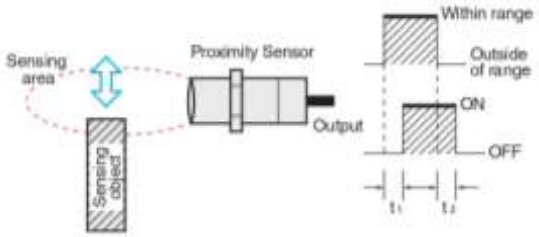

Fig 10:Response Time

viii) Response Frequency:

The quantity of recognized reiterations that can be yield consistent with Second when the standard detecting object is over and over included into proximity. See the related graph for the estimating approach.

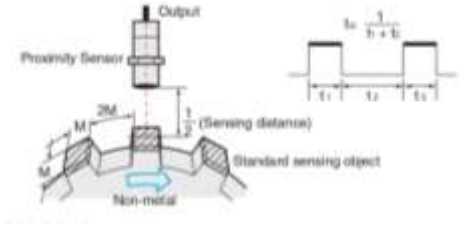

Fig 11: Response Frequency

ix)Shielded:

Magnetic flux is attentive in the front of the Sensor and coils are included with metal.The Sensor may be set up through fixing it into metallic.

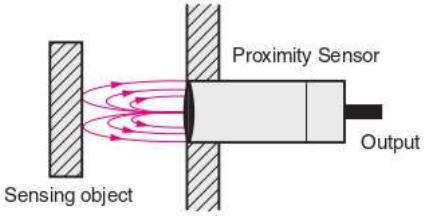

Fig 12:Shielded

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x)Unshielded:

With an Unshielded Sensor, magnetic flux is extent widely in front of the Sensor and the sides of the Sensor coil are not added with metallic.This version is without issues stricken by encompassing metal object (magnetic gadgets). Hence attention should to be taken in determining on the mounting area.

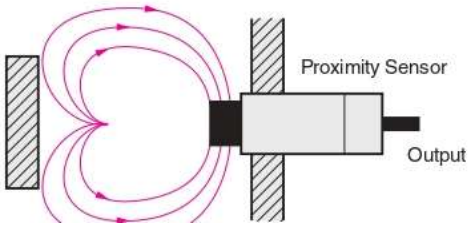

Fig 13:Unshielded

a)MOVEMENT CONTROLLING THE ROBOT:

Signal recognition utilizes 4 directional photodiodes to encounter thought about IR quality (sourced through the consolidated LED) to change physical movement information (i.e. speed, heading and separation) to a virtual truth. The signal motor goes with a huge assortment of versatile device motioning necessities: basic UP-DOWN-RIGHT-LEFT motions or progressively complex motions can be vitally detected. Force admission and commotion are most minimal with IR LED timing.
Functional Block Diagram:

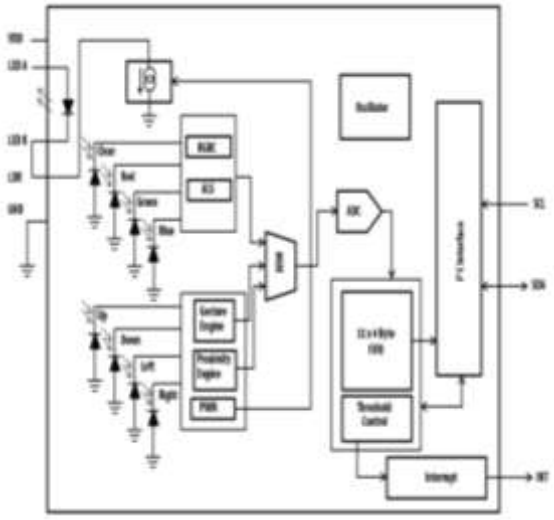

Fig 14. Functional Block Diagram

I/O Pins Configuration:

Pin	Name	Type	Description
1	SDA	I/O	I²C serial data I/O terminal - serial data I/O for I²C-bus
2	INT	O	Interrupt - open drain (active low)
3	LDR		LED driver input for proximity IR LED, constant current source LED driver
4	LEDK		LED Cathode, connect to LDR pin when using internal LED driver circuit
5	LEDA		LED Anode, connect to V_{LEDA} on PCB
6	GND		Power supply ground. All voltages are referenced to GND
7	SCL	I	I²C serial clock input terminal - clock signal for I²C serial data
8	V_{DD}		Power supply voltage

Table 1: I/O Pins Configuration

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Operation:

The Gesture location work offers development ID through directionally touchy photodiodes to encounter considered IR vitality by incorporated LED. Motion impacts are influenced by three essential components: IR LED emanation, IR gathering, and natural variables, including movement. During normal activity, GMODE is reset while every one of the 4-bytes of a motion dataset fall underneath the leave limit, GEXTH. To forestall troublesome go out, a resilience sift through is likewise secured; leave will best emerge if a back to back scope of underneath-edge results is more noteworthy or same to the persistence cost, GEXPERS. Each dataset final product that is above-edge will reset the resilience depend. Bogus or inadequate motions (motor passage and exit without GVALID progressing high) will no longer produce a motion intrudes on, GINT, and FIFO records will naturally be cleansed.

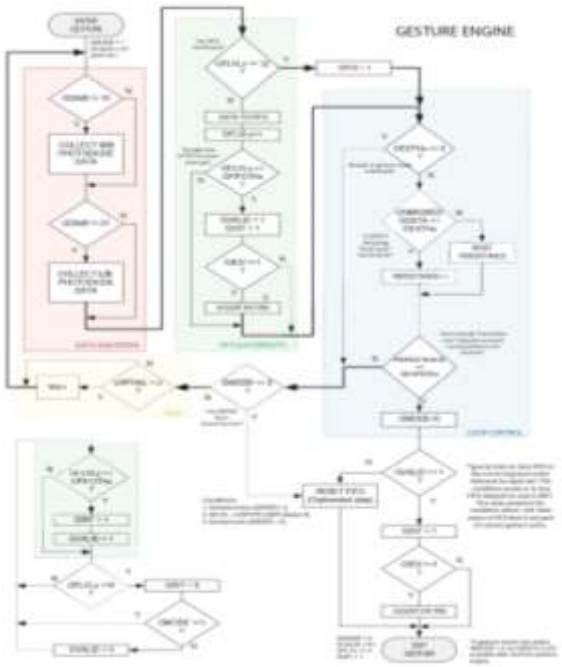

Fig 15:Detailed Gesture Diagram

Once in running in the IR reception signal way start with IR detection on the photodiodes and ends with the 4, eight-bit gesture results similar to accumulated signal strength on every diode. Signal from the four photodiodes is amplified, and offset adjusted to optimize overall performance. Photodiodes are paired to form two sign paths: UP/DOWN and LEFT/RIGHT. Photodiode pairs can be masked to exclude its consequences from the gesture FIFO records.

	Case 1	Case 2	Case 3
ILED (mA)	100	150	300
GPULSE (no of pulses)	8	8	8
GPLEN (us)	16	16	32
GWTIME (No of wait state)	2	2	1
Total Current (mA)	3.76	5.49	16.14

Table 2: Simplified Power calculation

Ideally, gesture detection works with the aid of capturing and comparing the amplitude and phase difference among directional sensor effects. The directional sensors are organized such that the diode opposite to the directional movement receives a larger part of the meditated IR signal upon entry, then a smaller element upon exit. The example, a downward or rightward motion of a goal is illustrated per the respective arrows in Figure 18

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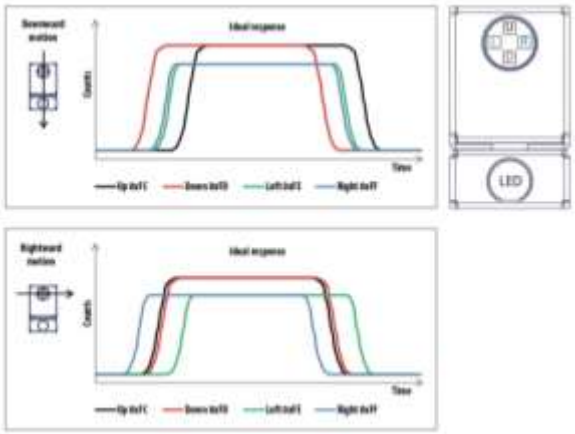

Fig 16: Directional orientation

b) MOVEMENT OF THE ARM:

Five axis control arm:

The 5 hub arm control is a finished arrangement of 5 hub vertically verbalized mechanical arm contraption intended for seat apex computerization. The grippers are the hand of the robots, and comes standard with superb work capabilities. At the highest point of the five-pivot gripper a wire shaper plier is utilized and with the assistance of apparatus engine the wire of the bomb is diffused. crankshaft belts and the minimized smaller scale venturing drives giving both speed and exact control. The 5 hub incorporates five distinctive rigging engine which is forward and loved with the assistance of the engine driver l293D. The Arm is skilled to pivot 360 degrees base turn, and others with at any rate 60 degrees of revolution.

Fig 17: Five axis control arm

Two axis control arm:

Two axis control robot is used to lift the bomb when in case the bomb is un diffusible and it cannot be diffuse. So to dispose the bomb it had to carry to the safe place.

Fig 18: Two axis control arm

Keyboard Control:

The Keyboard control has been used to control the
robotic arm, converting into an appropriate signal and providing it to the transmission module for transmission to the robot.

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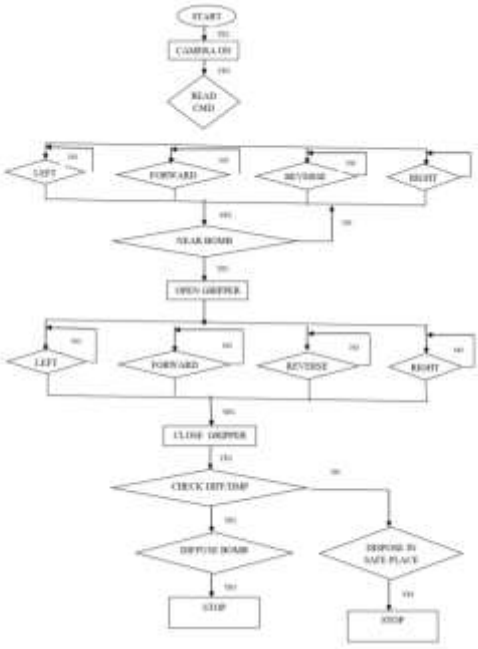

Fig 19: Movement of the arm

VI. EXPERIMENTAL RESULTS AND OUTPUT

a) Metal detection:

A metal detection segment together with an induction coil is employed to identify the distantly positioned target item (expected to be metallic). Whenever a metallic object is enclosed with the magnetic field of the induction coil, eddy currents are activated. These signals are exercised and fed to the microcontroller to produce a warning signal through buzzer at the controlling area.

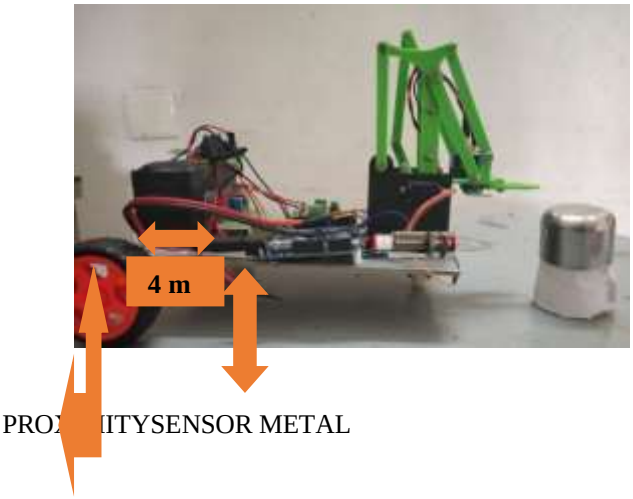

Fig 20: Metal Detection

b) Movement of the robotic arm:

The robotic arm is similar to human hand as it too has five degrees of freedom. The appropriate rotation at the joint is offered through the servos located at those joints. Hence it is analogous to a network of five sensors with each one at base, shoulder, elbow, wrist and gripper regulated by five distinct potentiometers wirelessly.The gripper located at the tip of the arm accomplishes function such as picking or dislocating the exploited object, cutting wires and further activities regarding bomb disposal.

Fig 21: Movement of the robotic arm

VII. CONCLUSION

Artificial intelligence have been employed for explosive ordnance (EOD) missions from the last decade. Modern developments and enhancements in the area of robotics have encouraged them to the promenience EOD. The one that is unbelieveable is now feasible for human beings to carry out with a blast suit owing to the usage of cutting edge robotics. With this rate of advancement in the field it is best a matter of time before robots fully eclipse Humans in EOD, thereby infinitely diminishing the threat of any Human survival. The latest trend of EOD robots lets them explore several grueling terrains, accumulate and demolish explosives, and offer increased reconnaissance to law enforcement and military bodies. The intuitive understanding and cognitive skills of the robot furthered with less cost, ease of maintenance alone makes it a more charming possibility over the years to come.

VIII. REFERENCES

1. Abdul Kadir Bin Motaleb, Mohammad Busayeed Hoque(2016) “Bomb disposal Robot” IEEEInternational Conference on Innovations in Science, Engineering and Technology
2. V. Abilash1 and J. Paul Chandra Kumar2(2017) “Ardunio controlled landmine detection robot”International Conference On Science Technology Engineering and Management (ICONSTEM)
3. Ahsanul Hoque, Md. Baijid Hasan Shorif, Shekh Nuruzzaman, Md. Eftekhar Alam(2017) “Arduino based Battlefield Assistive Robot” IEEE Region 10 Humanitarian Technology Conference (R10-HTC)
4. Akib Jayed Islam, Sadman Shahriar Alam, Khandoker Tanjim Ahammad, Fazllul Karim Nadim, Bithi Barua (2017) “Design, Kinematic andPerformance Evaluation of a Dual Arm Bomb Disposal Robot” International Conference on Electrical Information and Communication Technology (EICT),
5. Alejandro Suarez , Guillermo Heredia , and Anibal Ollero(2018) “Physical-Virtual Impedance Control in Ultralightweight and Compliant Dual-Arm Aerial Manipulators” IEEE Roboticss and automation letters, VOL. 3, NO. 3
6. Andrea Manno-Kovacs, Elisa Giusti, Fabrizio Berizzi,Levente Kov´acs, (2018) “Image Based Robust Target Classification for Passive ISAR” IEEE sensors journal(Volume:19 , Issue:1 , Jan.1, 1 2019)
7. Dakshit Chalagulla, Jeevanigi Jayateertha , Tamanneeta Giri, Sailaja. V(2018) “Gesture Controlled Bomb Diffusing Mobile Robot” International Conference on Intelligent Computing and Control Systems
8. Davorin Ambrus,Darko Vasic, Vedran Bilas (2016) “ Robust Estimation of Metal Target Shape Using Time-Domain Electromagnetic Induction Data” IEEE Transactions on Instrumentation and measurement (Volume: 65 , Issue: 4 , April 2016)
9. Francesca Lunardini, Claudia Casellato, Andrea d’Avella, Terence D Sanger and Alessandra Pedrocchi (2015) “Robustness and reliability of synergy-based myocontrol of a multiple degree of freedom robotic arm” IEEE Transactions on Neural Systems and Rehabilitation Engineering (Volume: 24 , Issue: 9 , Sept. 2016)
10. Geng Yang, Jia Deng, Gaoyang Pang, Hao Zhang, Jiayi Li, Bin Deng, Zhibo Pang, Juan Xu, Mingzhe Jiang, Pasi Liljeberg, Haibo Xie, Huayong Yang, (2018) “ An IoT enabled stroke rehabilitation system based on smart wearable armband and machine learning” IEEE Journal of Translational Engineering in Health and Medicine (Volume: 6)
11. Haowei zhang,Junwei xie, Junpeng shi,Zhaojian zhang,Xiaolong fu (2019) “Sensor Scheduling and Resource Allocation in Distributed MIMO Radar for Joint Target Tracking and Detection” IEEE. Translations and content mining are permitted for academic research only. (Volume: 7)

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12. Zhou MA ,Pinhas Ben-Tzvi,(2015), "RML Glove—An Exoskeleton Glove Mechanism With Haptics Feedback" IEEE/Asme Transactions on mechatronics ,vol. 20, no. 2
13. S.Dinesh tharun,P.Siva kumar (2019),"Robust estimation by drone for surveillance and bomb detection using actuators" International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8, Issue-6S3