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A Study on Internet of Things: Overview, Automation, Wireless Technology, Robotics

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Abstract— Several technologies are integrated with the communication systems. Smart objects can be identified through unique id and can be tracked by its various factors. The escalation of the devices connected with the universal sensing networks for communicating creates IoT which actuates the network. For developing a common operating picture (COP) information is shared by sensors and actuators which is integrated with the environment. To create an awareness about the situation relevant information can be displayed as a single identical information. By wireless communication system technologies, the physical world and digital world will be linked in future.

Index Terms—Internet of Things, M2M Communication, wireless technology, Home Automation, Hand Eye Coordination, Robotic Arm.

I. INTRODUCTION

In today's world people are pressurized because of the work they got committed and forget to do some of their work and also they often have the mentality of someone to do their work in their absence. Making other persons to do work will not give satisfaction. Efficiency of work done by human will not match up with the work done by machine. If more work is given to human they get tired and efficiency gets decreased gradually. Work can be given to a machine to do efficiently also with more speed. For work to be done by a machine, communication plays a vital role. Machines need to be communicated with each other. The communication of billions of devices connected on network to transfer data is what called as Internet of Things. In everyday objects, the computing devices have been embedded into it, which has internet. So inter connection through the devices helps to send and receive data. In order to do a particular work, usage of software, other hardware devices with a technology involves, without any human work is termed as automation. Robotics is a surprising invention of human which can do work more than that of human with more speed. In existing system, the hand eye coordination system of a robot is used. Visual space of a robot is its eye

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for capturing data and hand actuator of a robot is its hand which picks up the object which is scanned by robot eye. The transfer of signals from eye to hand stimulates the hand to pick up the object which is conventional method. The machines communicate in a networked environment based on the unique identifier is Internet of things. Automation is carried out so that human intervention is eradicated.

II. STUDY PAPERS

A study is made on Internet of Things, smart city, technologies used and automation along with the robotics, hand eye coordination of robotic arm, robotic arm used in medical field for surgery and wireless technology used in home automation.

A. Smart Cities

To support smart city vision, Urban IoT is designed to exploit the advanced technologies of communication. His paper provides a survey on the architecture of Urban IoT, protocols and the enabling technologies. Solutions and the guidelines which has been adopted in the Padvoma project of Smart city [6] and Island deployment proof is specified.

To manage the plethora of devices M2M communications has been specified by ETSI for the applications of IoT. Easy Connect system is developed to manage the devices. The device of is characterized by its features [43]. Brick like software modules are used which is simple to develop device application and interaction.

B. Technologies

IoT provides interaction among plethora of digital devices which are internet connected. This paper [23] motivates the need for an middleware through an application of IoT, designed for predicting alcohol content in blood using smart watch sensor in real time. Survey is done on the existing middleware of IoT.

At Industrial automation, issues arises for some activities for which paper [31] proposes a solution to manage supporting control. The things which has internet are smart and can sense data from variety of sensor sources for monitoring activities.

This paper [44] focuses on challenges in IoT based digital manufacturing which achieves data interaction everywhere. The digital food manufacturing line PicknPack is used for implementation.

Experimental testbed is developed and deployed to sense the environmental data by connecting IoT device with Unmanned aerial vehicle. Patrolling mission [41] is executed within a specified area. An Experimental move is done to hunt merits and demerits of the technologies that has been adopted. This paper obtained a result that due to onboard IoTequipment, UAV does not experience any overhead. Network Joining time is expressed as QoS and delay of retrieval is expressed as data and the requirements are satisfied by packet loss ratio.

It can be deployed for larger scale environment in future to enable any development.

C. Automation

This article [30] describes the conveyor belt automation using machine learning algorithms. It recognizes the type of different electronic board. Webcam is used for processing the image. The information that is obtained from a WiFi module is used to sent the obtained information to a web page.

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Industrial Robotics like AGVS (Automated Guided Vehicles) has elevated because of the automation capabilities and reduced cost. For advanced material handling, context aware Cloud Robotics is introduced [20] where two CACR features are characterized. They are context aware services and effective load balancing. The primary functions of material handing are expressed using decision making mechanics and localization and mapping which is enabled by cloud simultaneously. Significant improvement of efficiency of energy is shown using CACR for material handling and by saving the cost.

For processing acceleration and Surface Electro Myographic (SEMG) signals, an algorithmic framework is used for gesture recognition. In the framework [29], a Bayes linear classifier and an improved dynamic time- warping algorithm are used, along with the wearable gesture sensing device which can be manipulated using 19 predefined gestures by the user using phone. With 95 percent accuracy the prototype which is developed, responds to each gesture instruction within 30 ms.The utility of the framework can be demonstrated by interaction testing along with questionnaire feedback.

Messages from one mobile to another can be sent using Short Message Service (SMS). In order to notify the updates of message to a person SMS Update Notification (SUN) is used (any SIM) from authorized user which can be accomplished by [39] the conjunction of GSM module with Raspberry Pi. The message sent will be received and displayed on monitor through a website by Raspberry Pi.

III. M2M COMMUNICATION

A. Communication

For M2M communication, research community need a standardized protocol stack cognitive radio enables a protocol stack is the main objective of this [2] article. Centralized cognitive medium access control (MAC) protocol is used as a routing protocol for cognitive M2M networks. Protection to the primary users are ensured and also the utitlity requirements of the secondary M2M network is fulfilled which is demonstrated by performance evaluation.

Active Recognition (AR) and Movement Recognition (MR) methods are used [15] to find out the patient is idle or in movement. Movement can be classified as walking, cycling etc. Accelerometer sensors are used for comparison along with the Support Vector Machine (SVM) decision trees and dynamic time warping. Recognition accuracy is good when comparing the proposed methods, above 90 percent accuracy is shown by SVM based approach.

B. Wireless technology

WSN is one of the technologies for IoT [19]. Computation is carried out after sensing and communicated by automated data collection and processing is done.

The Quantity of data collected from different sensor networks and ensuring the quality of it is a major issue. To address this kind of issue, a novel optimal network is developed that achieves full sensing coverage and guarantees regional connectivity. The sensors are deployed, which determines the minimum number for sensors to achieve connectivity degrees. Proposed models [35] are efficient by the numerical results.

For environmental and ambient monitoring, UDP based WiFicommunication, HTTP and Bluetooth Smart are used to record data at remote locations. The sensed data is [14] visualized from every device through internet connection and monitoring is enabled in

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geographically large areas. The feasibility of the systems are analyzed and they make an efficient solution.

Wireless Bomb Disposal Robot [36] uses a control application to control the robot at remote by the user using wireless technology. User input is transmitted to the receiver through zigbee and stimulates the robot to act. It can be useful for Police, Military, Nuclear. Step climbing mechanism, wireless video transmission, vision sensing technique can be the future scope.

C. Home Automation

Reducing the relevant variability of task and increasing irrelevant variability of task [16], joint angle variability and activation of muscle is structured. Uncontrolled Manifold (UCM) is used to analyze partitions. Teleoperation depends on experience.

Using android application, home appliances can be controlled since GPRS is connected to the ARM7 microcontroller, the appliances can be turned on and off [24] using mobile phone through the android application.

Three visual homing methods are proposed based on feature scale, bearing and combination of both. Simplified homing method is used in which it [27] scales the information to compute control commands by considering the computational cost. Performance on a series are related and advantage of proposed method is shown.

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IV. ROBOTIC ARM

A. IoT based robotics

Human behavior is unpredictable at often and changes from time to time. Robotic systems should be assisted with backend of cloud which gets data from sensors and wearables determines the tasks to be executed by robotic systems. This paper [34] provides a system architecture design that alleviate the insanity disturbances of the people.

This paper describes design of a course and laboratory for students to develop low cost prototypes of embedded devices. Low cost 32 bit SOC RISC micro controller module is used to build prototypes. For software development Cloud base C/C++ compiler is used. Robots and breakout boards [18] can be reused.

As technology [1] has developed robots make things effortless and uncomplicated four different gestures are used for controlling the robots as forward, backward, left, right. Gripper concept is used. MEMS is used in hand to give the movements. MEMS recognize when the user moves his hand. Mechanical movement is converted into electrical signals and sent to Raspberry pi by the MEMS. Through IoT Raspberry pi receives and controls through Cloud controller (ARM 7) receives signals and directs the robot.

Technological implications, open issues and target applications are discussed. Using IoT interface [25] robotic arm is controlled used in various industrial applications. It reduces human efforts by recording the movement and perform same tasks repeatedly.

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In order to recognize abnormal fire and the location of the fire occupied places, Multiple Integrated Arduino [17] can be controlled by Raspberry Pi 3 with two sensors and camera which is used to snap the image when fire is detected and update a message automatically to the nearby fire brigade. Fire suspecting system is provided to avoid false alarm.

B. Robot Arm

For two linked mobile robots [42], actuator failures can be dealt using kinematic and dynamic models with a physical link is employed. Adaptive dynamic control signals are designed and controlled by a kinematic controller to cover failure cases. The properties of asymptotic tracking and the stability of desired systems are ensured by combining the signals and the controller of dynamic models. The effectiveness of the proposed actuator failure scheme of compensation is verified using simulation.

Passivity based Adaptive Controller is designed [37] through which tracking can be achieved. Eye in hand camera is used to secure the view of an object. Image Adjustment method is developed, for grabbing and transporting an object, autonomous flight is carried out. The experiment results are demonstrated successfully.

Here industrial robot consisting of a torso, two seven degree of freedom arms and two three finger hands. Autonomous vision based target identification [10] and adjustment, grasp selection and force control to ensure stable and robust object manipulation without seeking help of human for grasping in a stable way. Robot RaConteur is used to integrate the heterogeneous components in a distributed communication environment. The system interfaces powerful analysis. The method is safe for plethora of complex sensing and manipulation task.

For executing cyclic or motions of explosive multi degree of freedom (DoF) effectively, variable impedance actuators are used. Robotic arm and behavior of human which is oscillatory is examined. Damping properties of plant is caused for excitable oscillation modes. When compared with the desired mode with the undesired mode [11], the undesired mode decay faster, which causes multi-DoF oscillations excitable. Results show that joint damping is approximately equal for serially structured elastic multi body systems. Subjects are able to control synergy based myoelectric interface. Proposed control scheme has strong co-contraction between antagonist muscles compared with muscle pair approach which is traditional, used for user friendly application to assist robotic devices.

Subjects are able to control synergy based myoelectric interface. Proposed control scheme [28] has strong co- contraction between antagonist muscles compared with the traditional muscle pair approach for user friendly application to assist robotic devices.

The assignment of decoupled and non conflicting control frames in dual arm and dual operator teleoperation reduces TCT (task completion time) and [32] unwanted contacts. Comprehensive experiment demonstrates the AST control framework efficiency in dual operator teleoperation.

Estimating the deformation properties is a major complication for controlling the shape of an object automatically. An algorithm is developed [9] to provide a valuable adaptive behavior to the deformation controller which can be used in food industry, home robots, medical robotics and manufacturing.

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C. Hand eye coordination

This paper introduces [12] a reverse method of hand eye coordination method, which transfers stimulus signal form robotic visual space to hand actuator space. Reverse method enables which imparts "Stop to Fixate" on the robot, which provides an enhances Reaching ability, is demonstrated by the experimental result. Also when an unseen object is touched by the robotic hand, the reverse channel is enabled which drives he robotic visual system to notice what object is touched by the hand actuator space.

In this paper [22], a calibration free robotic eye hand coordination is addressed. A non linear mapping is used in the image Jacobian matrix between robotic control space and the image space. The unmodeled dynamics and external disturbances are estimated by the extended state observer initial. When compared with the conventional method, the proposed controller is independent of specific tasks and system configurations. For calibration free robotic eye hand coordination, a general design is proposed which provides effectiveness in performance by simulation and experimental results.

A standard method is proposed [21] to approach the problem of the uncalibrated robotic hand eye coordination. Controller design of a universal framework is provided for coupled and decoupled hand eye systems to execute the task of dynamic tracking for different configurations.

For a constantly changing configuration of the systems, coordination relationships between the devices such as camera and tools have to be determined for accurate robotic cooperation. Properties of [26] generic geometry and lemmas are presented which leads to the derivation of the final simultaneous algorithm. Closed form solution is introduced for accurate iterative solution. Under various movements of the robot and the noise levels, two non simultaneous methods are compared to show the feasibility and accuracy of the proposed method of simultaneous calibration.

Object classification [3] is done by the color of the object which moves on conveyor belt. A particular color of an object is detected by light intensity to frequency converter method. DC servo motors are used to control the robotic arm. The response of the system is slower than expected which could be improved using advanced color sensor and microcontroller.

Movement of objects on conveyor belt in 3D and for grasping, robotic arm with gripper is used to pick up the moving objects on conveyor belt. Dynamic integrated sensing and actuation system is built [5] that addresses three distinct problems of hand eye coordination method for clutching the objects moving on conveyor belt. Fast computation of 3D motion parameters, predictive control of a moving object and interception and grasping. Sensing to actuation are related by an algorithm that has been developed that can be applied for complex robotic tasks.

While dealing with the real time environments, Robotic hand eye co-ordination plays a vital role. To build robots learning system, infant development patterns are introduced. To control the robot, brain like computational structure [8] is constructed and an algorithm for hand eye coordination is built using infant behavioural patterns. Incremental learning of behavioural competence is achieved through the learning approach in a faster rate.

Objects on the conveyor belt is discarded when not in desired color or of shape using linear actuator. This [40] can be achieved using Raspberry Pi 3 and USB camera.

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D. Surgery

Engineering challenges of instrument design, intra operative guidance and intelligent human robot interaction are reviewed [38] with allied technical approaches. Research opportunities and emerging designs are highlightened. With the help of stereoscopic viewing device and two liquid crysal displays, surgeon controls the robotic system [4]. User monitors and controls the robot setting to view and manipulate 3D MR images. Wireless communication system is used for audio feedback. Surgeons are integrated with advanced imaging and robotic technologies by the workstation components.

V. APPLICATIONS

The applications are as follows:

1. Industrial field
2. Medical field
3. Robotics
4. Defense purpose

VI. LIMITATIONS OF THE EXISTING SYSTEM

The limitations of the existing system are as follows:

1. The robotic arm is specified to a certain region of space around it since it cannot pick or grab an object which is far beyond from its reach of ability to touch or pick the object.
2. In recognizing the activity or the movement of active recognition method and movement recognition method, the support vector machine doesnot provide good result with more accuracy.
3. MEMS sensor senses the object with the limited number of gestures.
4. Accuracy in the results can be achieved only if the Camera module can notice the objects in a brighter environment.

VII. CONCLUSION

A study is made on technologies and overview of Internet Of Things, hand eye coordination of robotic arm which senses the object and stimulates the robotic arm to pick. Automation minimizes the human intervention and reduces the workload of human. Wireless technology is used to communicate from the remote location. Internet of things is a technology which is used in many fields handling plethora of devices. The limitations and challenges of the existing system can be improved by using latest and more advanced technologies in future.

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