

Design of IoT Robot for Military Applications

IoT Applications in Defense & Security

Pawanraj S P

Department of Computer Science & Engineering
East West Institute of Technology
Bengaluru, India

Jagadeesh B N

Department of Computer Science & Engineering
East West Institute of Technology
Bengaluru, India

Abstract:- Consider the military soldiers who are not autonomous robots or remote-controlled mobile robots. They are living beings. They have emotions, fear, and limitations and are inaccurate compared to machines and robots. They are sensitive to external factors and are subjected to environmental effects easily. The expenditure bared by the Government is very high for deployed forces like salary and other expenditures. Life Losses occurs often in the borders. Modifications and Up gradations cannot be made possible for soldiers. Humans or deployed forces are subjected to factors such as Diseases that are Infectious, Non-Battle Injuries that occur, Injuries from Heat and Cold, Stress that are Psychological, Toxic Industrial Chemicals, Weapons that are Chemical or Biological. Hence the solution is to build an IOT controlled robot system for defense & security.

Keywords:- *IoT; Internet of Things; Robot; Wireless Communication; Sensor; Defense; Security; Soldiers; Deployed Forces; Microcontroller; Bluetooth; H-Bridge; DC Motor; Motors; Actuators; Relay drivers; Indicators; Android; Testing.*

I. INTRODUCTION

This paper presents an approach of an IR & camera based security system for protected areas, which senses the intruders, trespassers and transfer video to other end for confirmation. This system is embedded with an IR Sensor which senses any intruders / trespassers and will activate the alarm as well as switch on the guns in that particular place. The robot will shoot the intruder when he crosses the border. It will likewise initiate the Camera, which will begin recording the live video and transmit the equivalent to the collector end, the advanced cell. In a similar time it will begin gives alert and the information will moved through the RF Transmitter and Receiver to the cell phone.

II. LITERATURE SURVEY AND REVIEW

The literature survey and reviews for the regarding are as follows:

[1] In this paper the proposed security arrangement depends on our novel mix of camera on Raspberry Pi. Raspberry Pi works and controls camcorder for reconnaissance and records video for future playback. The other significant preferred position is that it is a basic circuit where specific working framework must be introduced so the picture can be shown. Raspberry Pi devours more force when contrasted with a PC utilizing INTEL Pentium 2

processor. The Raspberry Pi's memory is likewise constrained which is been defeated in the current proposed framework which utilizes External EEPROM memory AT24C02/4/8/16/32A having a high adaptability in volume. Raspberry Pi utilizes L293D Driver chip. [2] Security of an individual is essential worry in any industry particularly in underground coal mining industry. Underground correspondence is important to screen underground ecological parameter, for example, temperature, humidity, harmful gas and so forth and take fundamental activities in like manner to stay away from any sorts of risk. In this paper a robot based remote checking and security framework for underground mines utilizing remote correspondence convention zigbee is proposed, which will take the information of natural parameters of underground mine utilizing various sensors and send the information to control room utilizing zigbee. This entire framework will be put on a robot which is worked by remote. Utilization of remote robot will lessen the human intercession in security framework and will improve the wellbeing. [3] This paper presents the improvement of a model of an independent android based versatile robot for gas spill discovery and confinement in huge modern offices. The idea thought of a framework that is ready to perform examination undertakings in modern offices while not getting to risky territories straightforwardly and keeping in mind that not requiring any human nearness. The robot might be utilized for routine reviews of offices or for focused examinations of explicit framework parts. The independent nature of the framework was implemented with changed route sensors and in this way the decision of manual intercession by means of gadget whenever. The advancement of creative observing procedures that capitalize on best in class estimation and computerization innovation just as mechanical technology guarantees improvement in the dependability, productivity and cost-adequacy of investigations. At indistinguishable time, it alleviates specialized work force of dull, long and effortful assignments. [4] Robots are exceptionally structure for human to make our life simpler. Robots are structure for different purposes like military reason, industry, for locally situated application. At outskirts various kinds of tanks, rockets and weapons are utilized by the adversary. This causes issues and will hurt our power or troopers. Hence in this paper a robot is structured and produced for military reason application to ensure our military. The strategy includes a biped strolling robot utilizing equal leg instrument for example PLM which incorporates various capacities like catching certifiable information utilizing advanced picture handling used to recognize its impediment which is found in its way. [5] Robots assume a significant

job in numerous different backgrounds and are widely utilized in the territories of safeguard, enterprises, clinical and home apparatuses. They can do diverse dangerous employments that are impossible by human. The robot framework can be worked with the current monetary condition that can be utilized for various refined automated application. In this paper the control framework or system comprises of Touch screen and ZigBee modules, a microcontroller that gathers and controls the robot. The framework gives nonstop visual checking through the remote camera connected to the robot and sends consistent information to the control unit. The mechanical arm fitted on the robot is utilized for pick and spot tasks while the laser weapon appended to the robot is used to hit the objective item. The body of the robot comprises of two wheels joined to outfitted engines. The robot is controlled through a Touch screen which is mounted on ARM9 by means of "ZIGBEE" gadget. [6] The vast majority of the military association currently takes the assistance of robots to do numerous hazardous employments that is impossible by the warrior. These robots utilized in military are generally utilized with the coordinated framework, including video screens, sensors, gripper and cameras. The military robots likewise have various shapes as indicated by the reasons for every robot. Here in this paper a new system is proposed with the assistance of low force Zigbee remote sensor system to follow out the gatecrashers and the robot will make the important move consequently. Hence the proposed framework, an Intelligent Unmanned Robot (IUR) utilizing Zigbee spares human live and diminishes manual mistake in barrier side. This is uniquely structured mechanical framework to spare human life and shield the nation from foes. [7] Robots are being utilized now-a-days for an assortment of purposes, which replaces people work. Remote imparting robot is another age type in apply autonomy field in which looks into are being held so as to ad lib in those regions where these robots can build their mobility and attainability. This paper presents a gas recognizing robot, an age of robots which gives a response to the issues of coal mineshafts and gives simplicity to the aggressor tasks in war fields. The gas distinguishing robot has numerous utilizations, for example, it can identify risky gas just as mines in the war fields. The remotely controlled automated vehicle is joined with sensors and a camera which helps in catching the video of the environmental factors to a framework. The robot is actualized with the assistance of Bluetooth which helps in sending the subtleties of the framework environmental factors. This sort of robot is constrained by a remote controller which helps in the development of robot in territories. [8] This paper presents a cutting edge approach for reconnaissance at remote and outskirt regions utilizing multifunctional robot dependent on current 3G innovation utilized in safeguard and military applications. This automated vehicle has capacity to substitute the soldier at outskirt territories to give reconnaissance. The mechanical vehicle works both as self-sufficient and physically controlled vehicle utilizing web as correspondence medium. This multisensory robot used to recognize human, bombs, unsafe gases and fire at remote and war field territories. Routinely, remote security robot obsolesces because of restricted recurrence range and

constrained manual control. These restrictions are conquered by utilizing 3G innovation which has boundless range. This framework additionally improves the utilization of inexhaustible asset of vitality by outfitting with sun oriented board. A self-ruling activity is constrained by ultrasonic sensor and infrared sensors. Manual activity is constrained by DTMF decoder and phones utilized as camcorder by introducing 3G video call and change the way of robot as indicated by ongoing data of encompassing. This paper likewise delineates the exploratory consequences of tilt point choice of sun based board and force utilization in programmed and manual mode. This automated vehicle is intended for observation just as reconnaissance in specific situations.

III. SPECIAL FEATURES OF THE ROBOT

The following are the special features that the IoT controlled robot possess.

- Wireless Movements–Forward, Reverse, Right & Left
- All axes of the robot will have 360 Degree Rotation with Angle free movements.
- Sensors– Motion Sensor is featured which senses a trespassers
- Sensors–Ultrasonic, Obstacle detection & Direction changing
- Wireless Solutions – RF
- Obstacle Sensing
- NG and Collision Avoidance
- Direction Sensing
- Mechanical Model For Real Time Operations
- Stepper Motor OR
- Stepper Power Supply Board
- Optocoupler with Stepper Driver Board
- Auto Dialer
- RS 232 Converters OR
- Power Source
- RF Receiver OR
- Transmitter Module - 433.92 Mhz (Ft-Com-Rx2), Bandwidth – 4 Mhz

IV. REQUIREMENTS SPECIFICATION

A. Components

- Power Supply 5v DC - 7805
- Micro Controller - AT89C52 - ATM
- External EEPROM Memory - AT24C02/4/8/16/32A
- LCD - (Liquid Crystal Display) 2 x 16
- Real Time Clock (RTC) - DS1307
- Serial Communication - MAX 232
- GSM Modem (900/1800 MHz)
- GPS Receiver (with license)

B. Software Requirements

- Android SDK 1.5 OR above.
- Eclipse IDE
- Java
- Embedded C
- Embedded Java

- KEIL-C Compiler
- Flash Magic Burner Software

C. Hardware Requirements

- Microcontroller Board
- Optocoupler with Stepper Driver Board
- Stepper Power Supply

V. SYSTEM ARCHITECTURE & DESIGN

A. System Architecture

The below diagram illustrates the system architecture of IOT controlled robot. The microcontroller is the controlling unit of the entire robot system. The diagram shows how the different components are connected to the microcontroller.

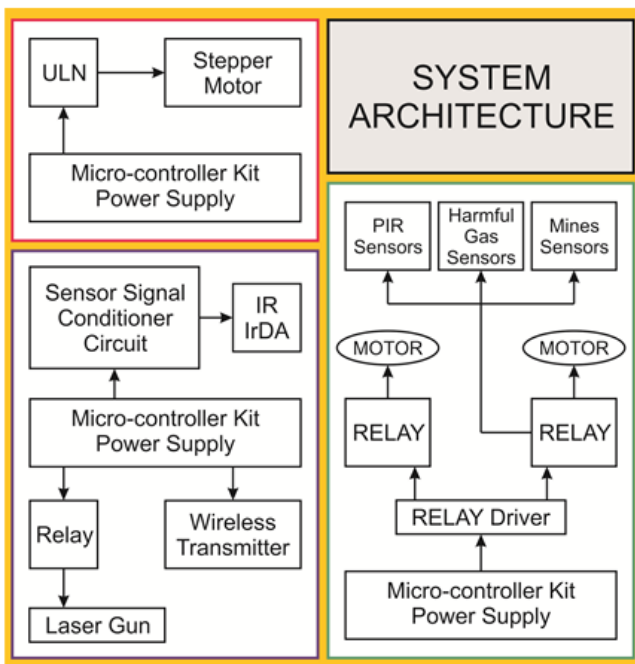


Fig 1:- System Architecture

B. Bluetooth Communication

The below diagram illustrates the Bluetooth communication between the robot and android app. The robot is embedded with Bluetooth and the android phone also installed with Bluetooth and the devices communicates with each other.

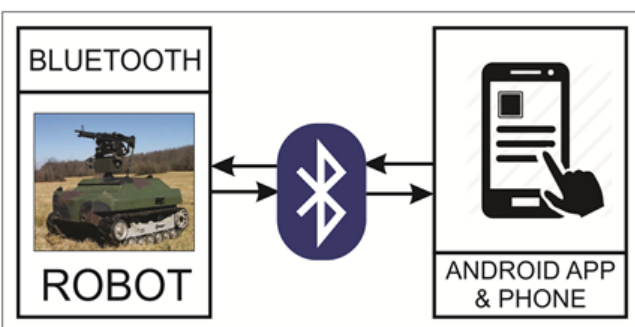


Fig 2:- Bluetooth Communication

C. Module Block Diagram

The below diagram illustrates the block diagram of different modules of the IOT controlled robot. As shown in the figure the microcontroller is connected to driving module, communication module and sensing module. The power supply module supply power to the microcontroller and all the other modules.

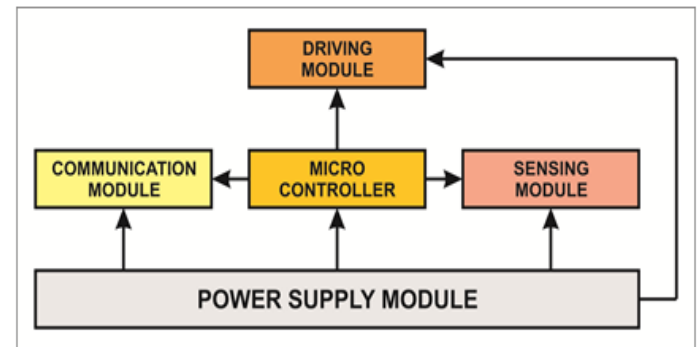


Fig 3:- Module Block Diagram

VI. MICROCONTROLLER

A microcontroller can be considered as a little microcomputer, which is instructed to carry out the particular tasks of inserted systems or frameworks like showing microwave's data, getting remote signs, and other actions. The general microcontroller comprises of the processor, the memory, serial ports, peripherals, and some other organs.

- Microcontrollers are utilized to execute a solitary errand inside an application.
- MC's structuring and equipment cost is low.
- Easy to supplant.
- MC is worked with CMOS innovation, which requires less capacity to work.
- It comprises of CPU, RAM, ROM, I/O ports and so forth.
- Microcontrollers are widely used in various different devices such as –
- LED's that detects and control lights.
- Microwave, Smokestacks, etc. that detects and control temperature.
- Fire caution, these are recognition and wellbeing gadgets for fire emergency.
- Measuring gadgets like Volt Meter.

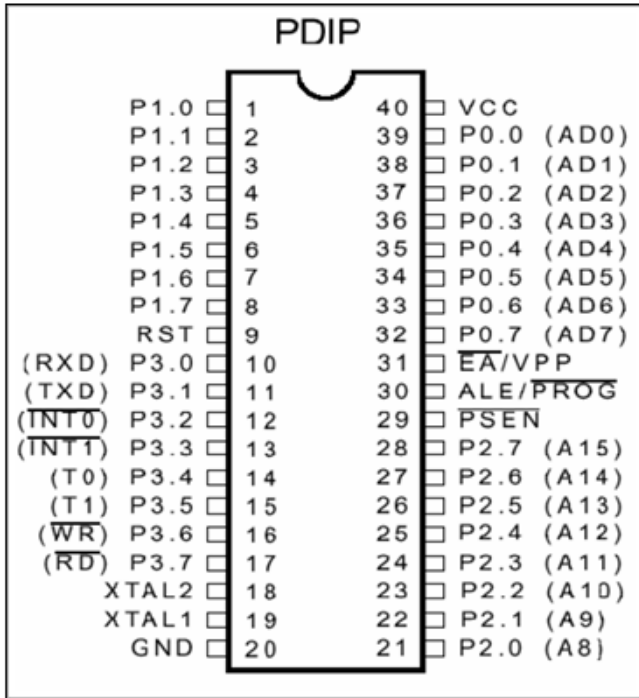


Fig 4:- Microcontroller Pin Diagram

VII. BLUETOOTH & H-BRIDGE

A. Bluetooth

Bluetooth remote innovation is a short range interchanges innovation proposed to supplant the links associating compact unit and keeping up elevated levels of security. Bluetooth utilizes Radio Frequency (RF) for correspondence.

Here are few special features that Bluetooth comprises that made Bluetooth gain popularity.

- Bluetooth provides a uniform structure for a wide scope of gadgets to associate and speak with one another.
- Bluetooth innovation has accomplished worldwide acknowledgment to such an extent that any Bluetooth empowered gadget, wherever on the planet, can be associated with Bluetooth empowered gadgets.
- Bluetooth innovation utilizes low power and maximum scope of up to ten meters has supported for a few use models.
- Bluetooth offers intuitive meeting by building up an ad-hoc system of PCs.
- Bluetooth use model incorporates cordless PC, radio, cordless telephone and cell phones.

B. H-Bridge

The H-bridge controls the heading of the turn of DC engine, without exchanging the leads. The H-bridge or H-connect is an electronic circuit that can drive the engine in the two bearings. H-spans are utilized in various applications such as to control engines in robots.

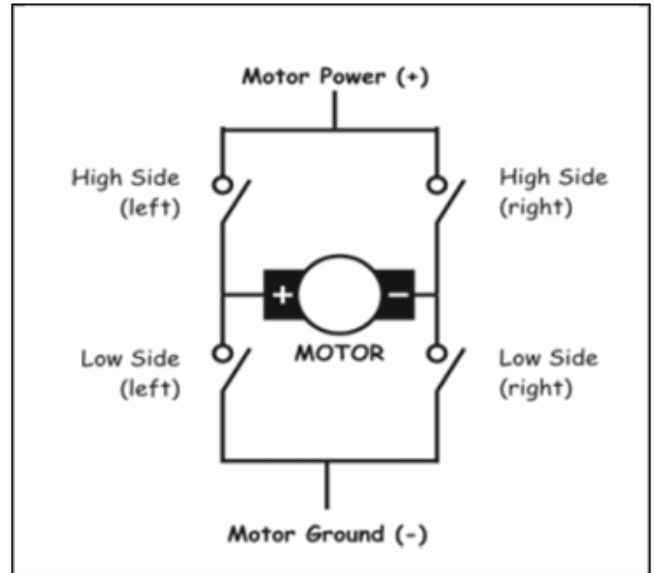


Fig 5:- Basic H-Bridge

In this system the L298 H-Bridge IC is used. The L298 controls the speed and bearing of DC engines and stepper engines. Also it can control two engines at the same time. Its present rating is 2A for each engine.

VIII. DC MOTORS

A. DC Motors

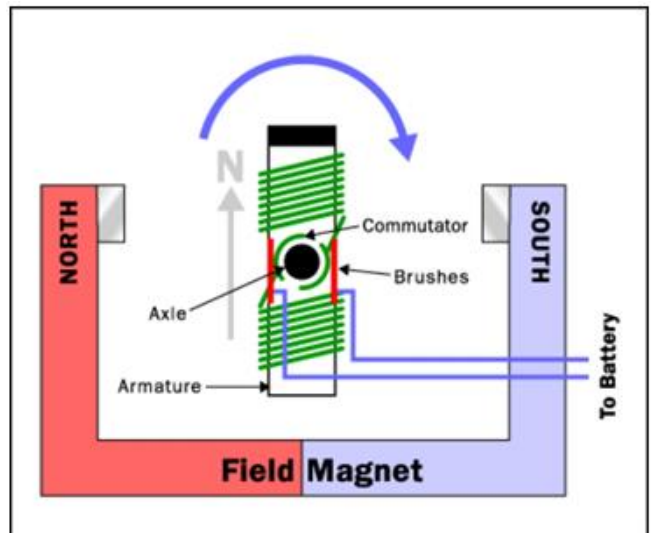


Fig. 6:- Principal working of DC Motor

A DC motor (Direct Current motor) is an e-motor which is much popular. DC motors typically have only two leads, in which one of them is positive and another one is negative. These two leads are straightly interfaced to a battery so that the engine will pivot. In the event if required to switch the leads, the motor will pivot the other way.

B. Armature, Commutator & Brushes

The armature has a hub, and the commutator is connected to the hub. The winding is wiped out to make the commutator increasingly self-evident. The commutator is basically a couple of plates appended to the hub. These plates provide the two associations with the loop of an electromagnet. The "flipping the electric field" some portion of an electric engine is cultivated by two sections which is the commutator and the brushes.

IX. MOTORS & ACTUATORS

A Servo Motor is a little gadget that has a yield shaft. This pole can be situated to explicit precise situations by imparting the servo a coded sign. For the length of time that the coded signal exists on the info line, the servo will keep up the rakish situation of the pole. In case the coded signal changes, the precise situation of the pole changes. To be specific the servos are utilized in radio-controlled planes to situate control surfaces like the lifts and rudders.

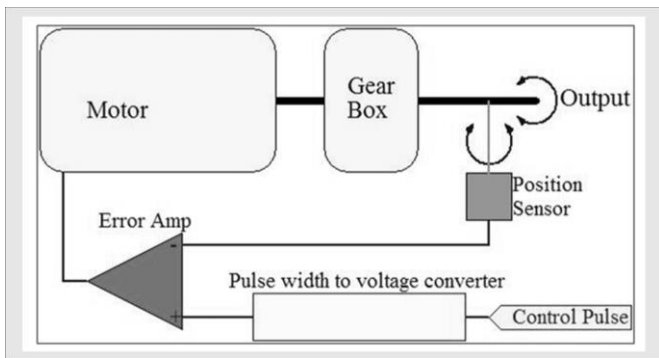


Fig 7:- Servo motor block diagram

A. Working of a Servo Motor

- The servo engine has some control circuits and a potentiometer associated with the yield shaft. This pot permits the control hardware to screen the present point of the servo engine.
- If the pole is at the right edge, at that point the engine closes off. In the event that the circuit finds that the edge isn't right, it will turn the engine until it is at an ideal point. The yield shaft of the servo is fit for voyaging something close to 180 degrees.
- The control wire is utilized to impart the point. The edge is dictated by the span of a heartbeat that is applied to the control wire.

X. RELAY DRIVERS & INDICATORS

A. Relay Drivers

A relay driver is an electrically worked switch. Current coursing through the loop of the transfer makes an attractive field which draws in a switch and changes the switch contacts. The curl current can be on or off so transfers have two switch positions and they are twofold toss (changeover) switches.

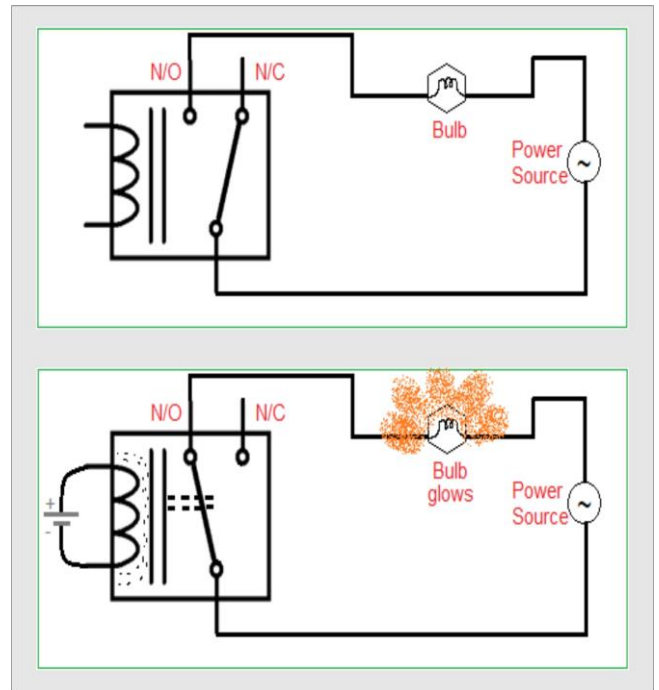


Fig 8:- Relay based LED

B. Indicators

A light-emitting diode (LED) is a semiconductor gadget that transmits noticeable light when an electric flow goes through it. In this venture Light Emitting Diode is utilized as a Visual pointer to speak to the state of the lift.

XI. ANDROID

Android is an open source and Linux-based system software i.e., operating system for devices mainly cell phones or smart phones. Android applications or apps are used in this system for controlling the movements of robots.

Android is featured with Bluetooth API and this API can be used to perform various operations such as follows:

- Bluetooth is used by a device to scan other nearby devices.
- The list of paired devices for a device can be obtained by Bluetooth.
- In order to connect to a device through Bluetooth discovery feature.

We utilize the android app for movement control of the robot system. The forward, reverse, left & right movement of the robot is controlled through the app installed in the smartphone.

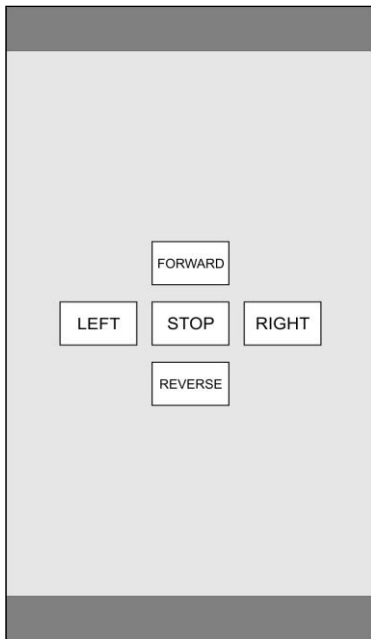


Fig 9:- Android App controls for robot

XII. TESTING

Testing is the way toward assessing a system/framework or its component(s) with the plan to discover whether it fulfills the predetermined necessities or not also to recognize any holes, mistakes, or missing prerequisites in spite of the real necessities.

The following are the types of system tests that have been conducted for the robot system. If the robot system passes in all the tests as mentioned the system can be considered as ready to be deployed.

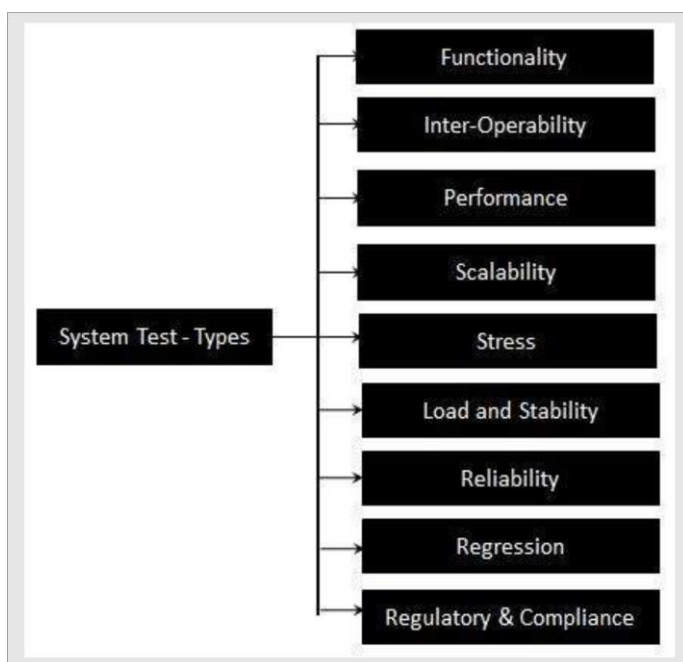


Fig 10:- System Testing Types

The IOT robot that is built has to be tested according to the different types of testing as mentioned in the above figure. Once the testing is successful the robot or the system can then be deployed or implemented for service.

XIII. IMPLEMENTATION & MAINTAINENCE

A. Implementation

Implementation is deployment of the system that has passed in the testing stages. Implementation stage is necessary for the users to study and analyze the robots operation for use and evaluation. The process involves certain session such as training the users to handle the system and define a suitable plan for a smooth conversion of the system.

Thus the IOT robot built has to be implemented for the purpose to be served. The robot is will replace the deployed forces in the military.

B. Maintainence

System maintenance confirms the system to its original requirements if any fault occurs and enhancement adds to system capability by incorporating new requirements.

Thus, maintenance changes and repairs the existing system, enhancement of the system integrates additional features to the existing system, and development activity replaces the existing system with a new one. Implementation is an important factor of system development process that includes the activities which corrects errors in system design and implementation, updates the documents, and tests the data.

There are certain classifications of system maintenance such as repairing can be considered as corrective maintenance, program replacement can be called as adaptive maintenance, enhancement can be defined as perfective maintenance.

Thus the IOT robot has to undergo regular maintenance after the implementation and deployment for its service.

XIV. APPLICATIONS

The following are the applications of the IOT controlled robot.

- The expenditure can be reduced up to a great extent for Government.
- Implemented in areas where Life Losses has to be prevented.
- Implemented where Modifications & Up gradations has to be made periodically.
- The areas where accuracy, performance & efficiency and high concentration is required.
- If autonomous robotics is required for assistance.
- Deployed in areas where emotions are to be avoided.

XV. CONCLUSION

In this paper, I presented a design for IOT controlled robot for military applications. The intention is to build a system that is an IOT controlled robot that will replace the human or living deployed forces. The paper contains the details with respect to the domain Internet of Things. An explanation regarding introduction to the development of the system is mentioned in the paper. This paper contains the list of special features that the robot possesses. This paper also contains the details of the requirements specifications such as components used, hardware requirements & software requirements. The system architecture of the robot is presented. The Bluetooth communication and module block diagram is also explained. The details of the hardware components such as the microcontroller, Bluetooth & H-Bridge, DC motors, motors and Actuators, Relay drivers & Indicators are explained. Also the role of Android and apps in smartphones are detailed in the paper. Also the Testing of the system along with implementation and maintenance are mentioned. The details about the applications of the system, The Major areas of applications of IOT and the robot are also mentioned in this paper.

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