ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 5, May 2016

Design and Implementation of Multitasking Robotic System for Defence

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***Abstract*— The 'multitasking defence robot' is a robot that primarily functions as a surveillance system and uses multi-weaponry technology like the laser gun and rocket launcher for defence as well as attack strategies. It uses a distance approximator to locate its target, which synchronizes with a real time camera. The robot is wirelessy controlled by radio frequency signals and the same depending on the requirement, controls the laser gun and rocket launcher. A smaller robot is located along with the main robot and may be utilized in areas with size is constraint. It can also perform functions like land mine detection, bomb detection, moisture detection, flame detection and majorly perform human detection to warn us in case of intrusion. The smaller robot is a flying unit with a real time camera and related sensors.**

***Keywords*—Bigger robot, Control unit, LASER diode, Control unit.**

INTRODUCTION

The implementation of Multitasking Robotic system into defence field as an advancementover application specific robot systems is named as the Multitasking defence robot .As the name suggests it does multiple tasks such as: Surveillance, Defence and Atttack.It is a system consisting of 3 sub-systems viz.: bigger robot system, smaller robot system and a control unit.

The Bigger robot has arrays of sensors and metallic arm acting as the attack unit, it has a missile launcher, distance approximator (target locator) and a laser gun. Using the PIR sensor it performs human detection, it can rotate 180x180 horizontal to vertical range to obtain precise target lock-on.

The Smaller robot will be deployed into the sky when the bigger robot cannot access the area due to size constraints. Both bigger robot and the smaller robot have night vision cameras for the continuous live streaming being sent to the control unit.

I. LITRATURE SURVEY

Bomb Slayers of the future DRDO Daksh.

Daksh, a remotely operated vehicle for defusing bombs, is undergoing trials. Developed by defence research and development organisation, it is semi-automated. It can climb stairs to reach hazardous materials. Using this robotised arm, it can lift a suspect object and scan it using its portable X-ray device. If the object is a worm, daksh can defuse it with its water jet disrupter.

From DRDO Daksh, the cogged wheel technology, ultrasonic sensors and camera system has been adopted.

US military Foster Miller Talon Sword combination inspired the operator control unit, missile launcher, IR sensor, camera, 180-180^{o} control launch station.

II. SYSTEM MODULES

This prototype contains three subsystems– Bigger robot system, smaller robot system and a control unit.

A central controller controls the robot prototype. Different modules are interfaced with this controller. The multitasking defence robot has ATMEGA328P microcontroller at its core. It is interfaced with ASK module for communication with the base station. It is connected to L293D motor driver IC for the control of the bigger robot motion. The motion of the ultrasonic distance approximator is controlled using servo motors interfaced to the controller. A latch for controlling the pathway for the quadcopter is provided, which can be controlled by the base station. A remote controlled rocket launcher, and a laser-firing gun is present. The bigger robot has a camera, metal detector, an IR proximity sensor, moisture sensor,flame or fire sensor and a PIR sensor . The smaller robot (the quad-copter) having a range of 500m radius has a real time video camera attached to it.The quad-copter has an independent control mechanism.

A. *Bigger robot:*

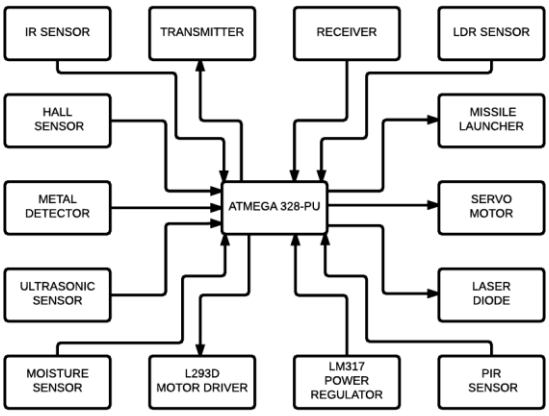

Fig. 1: Block diagram of the bigger robot

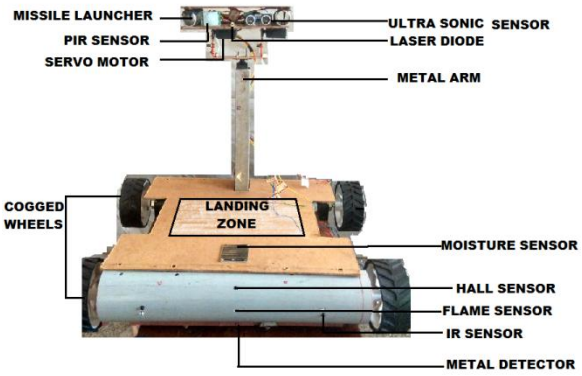

Fig. 2: Implementation of bigger robot

1) *ATMEGA328P microcontroller:*

The Atmega328p is a microcontroller chip produced by Atmel. It is an 8-bit microcontroller that has 32K of flash memory, 1K of EPROM, and 2K of internal SRAM. The Atmega328 is one of the microcontroller chips that are used with popular Arduino Duemilanove boards. The Arduino Duemilanove boards come with either one of two microcontroller chips, the Atmega168 or the Atmega328. Of these two, the Atmega328 is the upgraded, more advanced chip. Unlike the Atmega168 which has 16K of flash memory and 512 bytes of internal SRAM, the Atmega328 has 32K of flash program and 2K of internal SRAM.

2) RF module:

An RF module (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through Radio Frequency communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and/or receiver.

3) Metal detector:

A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. Another common type are stationary "walk through" metal detectors used for security screening at access points in prisons, courthouses, and airports to detect concealed metal weapons on a person's body.

B. *Smaller robot:*

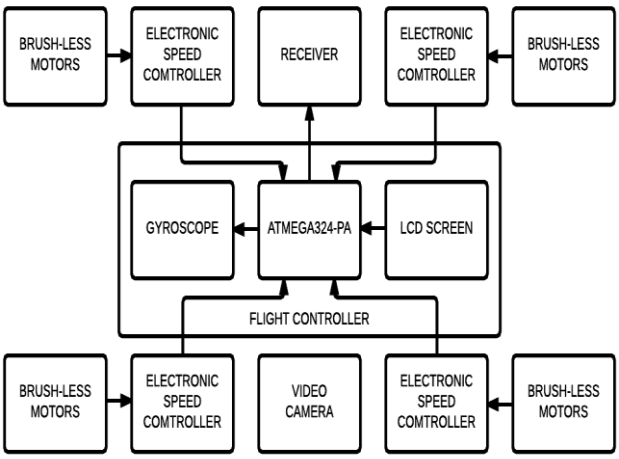

Fig. 3: Block diagram of the smaller robot

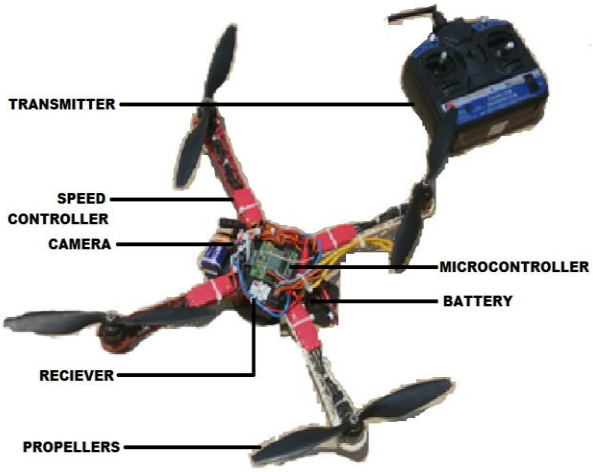

Fig. 4: Implementation of smaller robot

1) *Flight controller:*

A flight controller is the brain of a quadcopter or multicopter. To maintain balance, the quadcopter must be continuously taking measurements from the sensors, and making adjustments to the speed of each rotor to keep the body level. These adjustments are calculated using some very complicated algorithm in order to keep the quadcopter perfectly balanced. A quadcopter has four controllable degrees of freedom: yaw, roll, pitch, and altitude. Each degree of freedom can be controlled by adjusting the thrusts of each rotor.

C. *Control unit:*

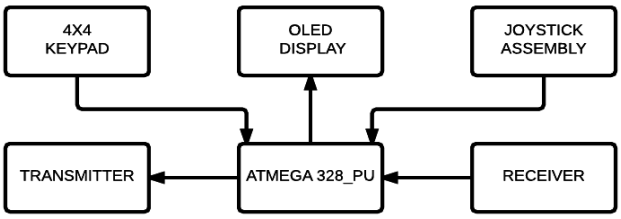

Fig. 5: Block diagram of the Control unit

1) OLED:

Fig. 6: OLED display

An organic light-emitting diode (OLED) is a light-emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. This layer of organic semiconductor is situated between two electrodes; typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens, computer monitors, and portable systems such as mobile phones, handheld game consoles and PDAs. A major area of research is the development of white OLED devices for use in solid state lighting applications.

2) *Accelerometer:*

An accelerometer is a device that measures proper acceleration ("g-force"). Proper acceleration is not the same as coordinate acceleration (rate of change of velocity). For example, an accelerometer at rest on the surface of the Earth will measure an acceleration g= 9.81 m/s^2 straight upwards. By contrast, accelerometers in free fall (falling toward the canter of the Earth at a rate of about 9.81 m/s^2) will measure zero.

3) *Gyroscope:*

A gyroscope is a device that uses Earth's gravity to help determine orientation. Its design consists of a freely-rotating disk called a rotor, mounted onto a spinning axis in the center of a larger and more stable wheel.

III. IMPLEMENTATION

The multitasking robotic system has three units: The Bigger robot, the smaller robot and a control unit. The robot can do multiple tasks such as attack, defend and surveillance. The heart of the bigger robot is the ATMEGA 328P Microcontroller The bigger robot has octa-wheel mechanism where it can be used to climb mountains, slopy areas and war torn region. The bigger robot contains an array of sensors such as metal detector which helps in detecting the land mines, IR sensors to detect obstacles, moisture sensor and magnetic sensor. There is also a metallic arm which is used to attack enemy targets, it has an ultrasonic sensor which acts like distance approximator and a PIR sensor to detect the variation in temperature. A laser gun is fitted onto the robot to lock on the enemy target. Along with it there's a rocket launcher.

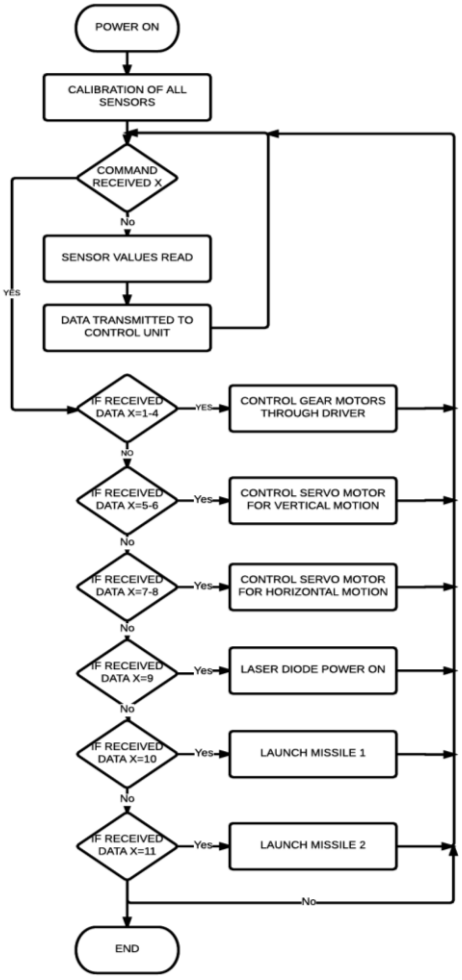

Fig. 7: Flowchart of bigger robot working

The smaller robot is a quadcopter which works on the principle of PID loops. It has an 80M628PA microcontroller which contains an accelerometer and a gyroscope. The power to lift the smaller robot into the air are given by the brushless motors which rotates at the rate of 10,000rpm. The quadcopter

is configured in X-shape. There is a camera attached to the robot which can capture real-time events and directly feed back to the control unit. The resolution of this camera is 640x400. The quadcopter has three axes of movement: pitch, yaw and roll depending on the command given.

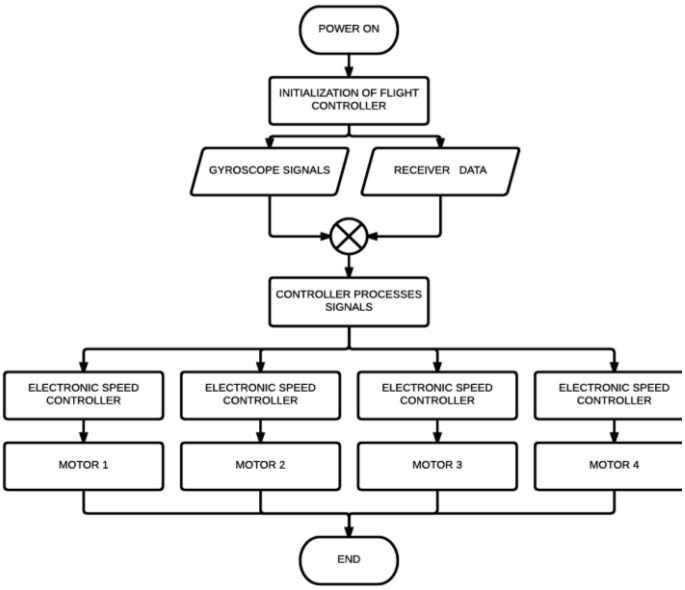

Fig. 8: Flowchart of smaller robot working

The control unit has a 128x64 OLED display which shows all sensor values. Both the robots have night vision cameras.

IV. Conclusion

This prototype can further developed to a product and utilised for a country's defence personnel. A combination of multitasking robots, drones, bomb disposal robots etc. from strong front line defence, and ensure minimum human causality.

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