Military Robot for Reconnaissance and Surveillance using Image Processing

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Abstract - *The use of robots is inevitable. It has stemmed from the need to reduce manpower in military organizations and at the same time satisfying the needs of said military organizations. The variety of situations and environment that places ever growing demands on soldiers and exposes the limitations of the human body also supports the adoption of robots. The timeframe for adoption of robots in military organizations is projected to be 50 years. Robots will not be limited to their current designs and will see evolution just like everything else as the potential of robots is uncovered through advancements in robotic technologies. Human life is precious and the loss of life can be reduced considerably with the use of robots in the armed forces.*

Key Words: PIR sensor, MQ6 Gas sensor, DHT11 Temperature and humidity sensor, Raspberry Pi, Image Processing, Face Detection.

1. INTRODUCTION

With the development of robotic technology researchers and scientists have come up with unmanned and remotely controlled robots. These robots make human life much easier especially in dangerous areas. One of the areas of concern today is the number of casualties war has. Military robots are used to perform risky jobs that are difficult to be handled by humans. These robots take the job of an assistant of a soldier. Today, almost all military organizations use military robots to perform risky tasks in risky environments. These robots integrated in the military are usually employed with a variety of integrated systems including video screens, sensors, grippers and cameras suitable for a variety of missions. These military robots can have different shapes according to the purpose of the task at hand.

The integration of unmanned robots in military organizations represents a milestone for them and signifies the beginning of a new age for robotics. Human life is precious and the number of casualties war takes every year can be curbed to a large extent with the use of robots for surveillance and reconnaissance to get the layout of the area and the hostile elements in it. Robots can be designed specifically to withstand harsh terrain, detect toxic environments, triangulate locations, remotely detonate bombs, remotely defuse bombs and countless other tasks which could be a risk to human life. In this paper we have focused on how the need and supply for military robots has risen in the past few years and also discuss the architecture and design for a robot capable of surveillance and reconnaissance using image processing for face detection using an array of sensors to detect toxic gases, detect metals and land mines, detect fires and other obstacles which can be controlled wirelessly from a distance. We start by surveying existing systems and what the proposed system has to offer.

1.1 Existing System

There is research work done for detecting landmines, fire, toxic gases and humans. But, the existing systems focuses only on one module.

1.2 Proposed System

Our system focuses on the development of a robot capable of detecting landmines, toxic gases, fire and positions of heat radiating life forms. Thus said system will perform multiple functions and hence is an intelligent multipurpose Warfield surveillance and scouting robot.

2. EVOLUTION AND ADOPTION OF ROBOTS

Advancements in robotics will be the driving factor in the evolution of robots and will be the reason for increase in adoption of robots across most military organizations. Using the projected adoption timeframe of 50 years as discussed earlier and assuming a separate evolution and adoption trajectory for F-bots and T-bots, a possible adoption and evolution path for military robots is projected in Graph 1. [1]
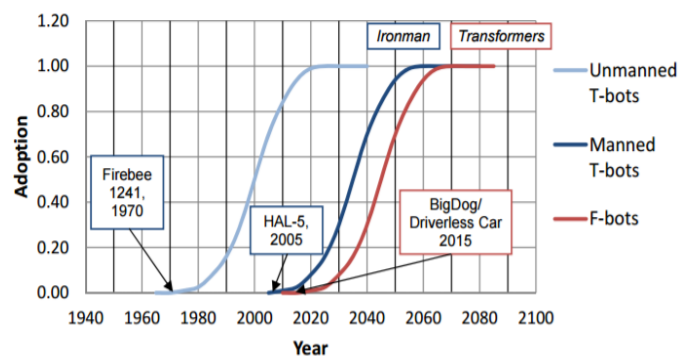
Graph -1: Projection for adoption and evolution of military robots.

While the adoption timeframe for the various robots has been projected to be 50 years, the actual timeframe will vary from organization to organization, depending on the need and rate of adoption within these individual organizations. The rate at which robots are adopted within an organization is dependent on the need, the investment or if they are able to invest in the research and development of robots. These rates will vary from organization to organization in accordance to the environment of said organization.

3. SURGE IN PRODUCTION OF MILITARY ROBOTS

Robots used for defense applications are still the most in-demand and are expected to stay that way in the coming times.

Sales of robots for defense applications are expected to maintain a substantial lead as the most highly-demanded service robots: The average sales from 2014-2017 are almost twice as high as the next-largest sector (milking robots) as seen in the chart 1.
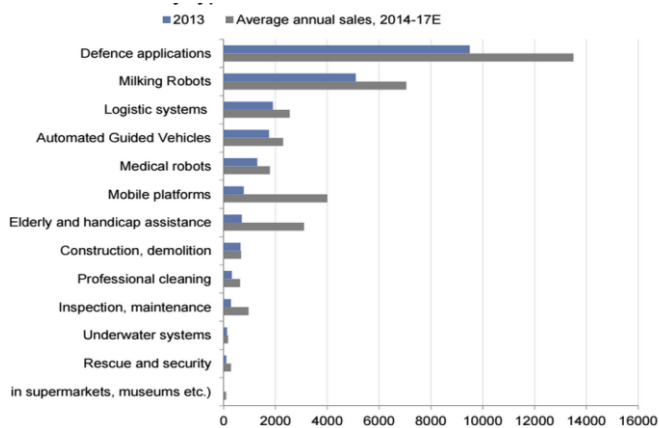

Chart -1: Average increase in sales of various robots (2014-2017)[4]

Fig -1: Architectural Design for Proposed system

4. ARCHITECTURAL DESIGN FOR PROPOSED SYSTEM

The bot is designed in such a way that minimum space is consumed vertically. All the sensors are attached on the frame along with the microcontroller which in this case is the Raspberry Pi 3. A MicroSD card is used with the Raspberry Pi for storage purpose. The database of the photos and IDs associated with each person is stored here.

Since the Raspberry Pi 3 supports wireless connection it is wirelessly connected to the same network the controlling system is connected to. Using Secure Shell we can boot to the Raspberry Pi on the system. Then using x11vnc we can remotely access the Raspberry Pi through the system using any remote access application.
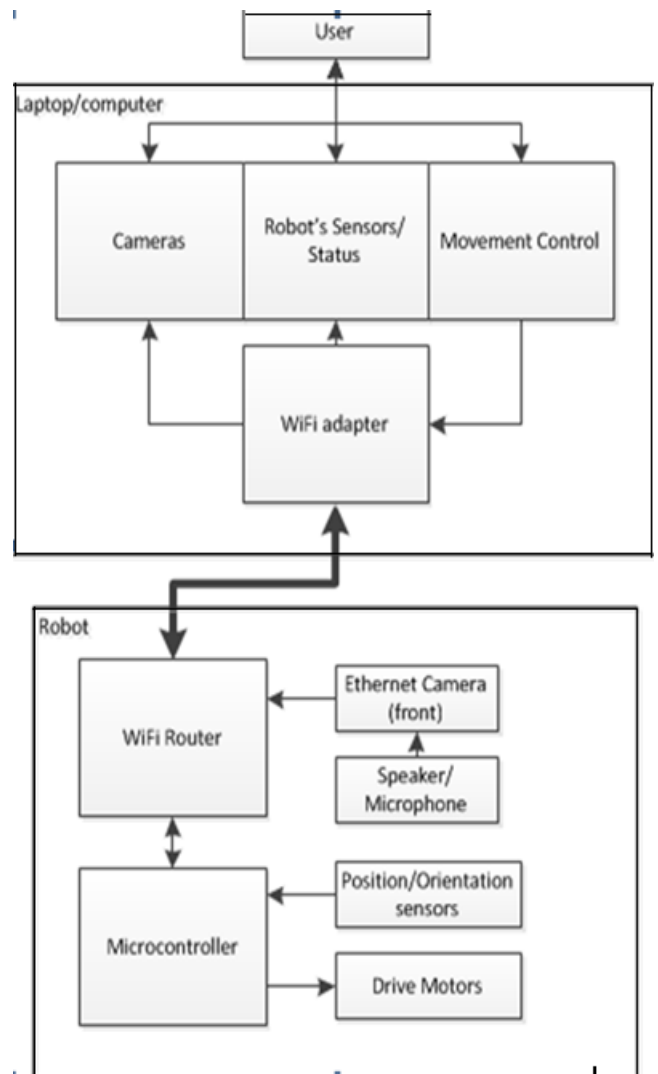
5. CONCLUSIONS

We have successfully deployed a robot capable of surveillance and covering harsh warzone terrain that can be controlled wirelessly. The robot recognizes every face that has been already updated in the database. It easily updates a new person in the database by scanning and taking 20 photos. The person is associated with a certain ID and the ID is associated with the person's name so when said person appears in front of the webcam the system detects facial contours using the photos in the database for reference and displays the name of the person. This can be used for hostage situations, finding fallen soldiers on the battlefield, retrieving stolen objects, surveillance in areas with gas leaks or radiation, to detect landmines and various applications. As our soldiers fight

with their lives on the line to protect our families the least we can do is make their life a little easier.

6. FUTURE SCOPE

The path forward involves a further cycle of experimentations and refinement of the image processing algorithm and various sensors that can be used for different situations. Every 3 to 5 man team can carry a robot that uses sensors to triangulate the location of all living bodies around by using Thermal Imaging. This will give the soldiers an advantage in situations where they are outnumbered or the enemy is prepared and is waiting for them. If they already know the locations of their enemies they can come up with a strategy and successfully maneuver the mission to their advantage. If it is a hostage situation the Thermal Imaging gives the shape of the body the person has taken at that point of time. Normally a hostage would be tied and guarded. Using Thermal Imaging they can identify who and where the hostage is so that they can come up with a strategy to rescue the hostage as well suffering minimal casualties. These robots can also be equipped with a bomb to be detonated when they are compromised or captured.

ACKNOWLEDGEMENT

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