Self Transforming Robot for Surveillance and Rescue

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Abstract— **It is very important to keep our border security forces well equipped with the latest technologies to prohibit unwanted occurrences and strengthen the troops. Real time videos captured by the camera mounted on it will be transmitted continuously for monitoring. This would most importantly help in saving human lives as it can be deployed into the sensitive areas where the risk of losing human life is high. In addition to the main aims of video surveillance and remote control, many more applications are added. Due to the modular structure of the proposed robot it can change its configuration which enable them to go through narrow spaces which is helpful in places where human cannot reach easily like building collapsed areas, landslide areas, flood affected areas etc. It is also possible to reconfigure and customize the proposed robot according to our needs and use it in various fields**.

Keywords - Surveillance, Robot, Real-time, Monitoring

I. INTRODUCTION

A robot is a machine-especially one programmable by a computer-capable of carrying out a complex series of actions automatically. Increase in use of robot in the modern world lead to afford more attention to the mobile robot. Robots can take on any form but some are made to resemble humans in appearance.

The robots are most commonly used in industry, military, search and rescue operations in hazardous environment and security locations. The major expected requirement of a mobile robot is, it should have the ability to replace human in performing the dangerous and repetitive task where human cannot perform easily. These requirements can be attained by the different types of modern robots. In order to phase the multiple adaptive environments, researchers on robot have established a number of mobile robot prototypes to carry out the required task.

The objective of this project is to build an advanced featured robot capable of multitasking and executing assembly tasks in human-like manner to contribute for military and society without much human intervention. In this project, control of robotic unit is from remote and with the use of internet and also it is able to get the video from the robot for the purpose of surveillance [1]. It is a quadruped robotic module built with number of servo motors [3]. It uses Brush DC motors and L298N. L298N are used to drive the Brush DC motors [4]. This focus on a category of distributed system composed of numbers of identical units which can dynamically change connections among themselves and this system is capable of scale extension or contraction, the scale of the system can be changed by adding or removing units [6]. The system can change its configuration by changing each module' s position and connection [7].

II. METHODOLOGY

The main motive of this project is to solve certain problems which are risky for humans to do. Considering the application of military purpose, the robot is equipped with a spy camera to meet the need of catching terrorists[4]. The camera will be collecting details regarding the presence of terrorists and stream it to user. So a RF transmitter can be added in the robot and RF receiver in the other end[1].

The main specialty of the robot is, it' s able to change dimensions according to external conditions[6]. The DTMF module can be used to changes the shape of it with the help of servo motors. The forward motion is made possible by using DC motors. The arduino is programmed in such a way that robot can even move through slopes, climb over steps, etc.

In the proposed system the robot is equipped with wireless Camera which will be monitoring and recording various external conditions as well as detect the hindrance occurring in the path. Also this robot has a wireless transceiver[1]. The main part of this robot is microcontroller based embedded

system with various other peripherals like servo motor, DC motor and motor driver.

The robot will be collecting various environmental conditions through which it is moving, change in the ambient light, its location details and also it captures its surroundings. These all collected data's will be processed through microcontroller board and the control signals will be passed to actuators for possessing alteration in its original shape to exhibit a human-like behavior while passing over the particular location[3]. Also the collected footage will be continuously streamed.

III. EXPERIMENTAL SETUP

The hardware part of the Self Transforming Robot consists of the controlling system, robot and the monitoring part. The DTMF module can be used to control the shape of it with the help of servo motors. The main part of this robot is microcontroller based embedded system with various other peripherals like servo motor, DC motor and IP camera[3].
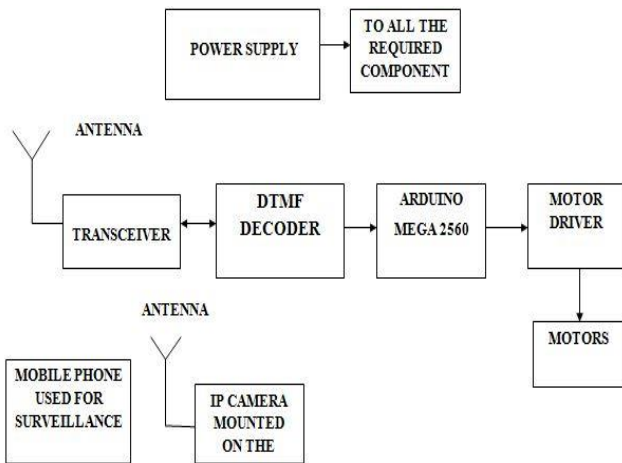

Fig (1.1): Block diagram of Self Transforming Robot

The hardware part of the Self Transforming Robot consists of the controlling system, robot and the monitoring part. The DTMF module can be used to control the shape of it with the help of servo motors. The main part of this robot is microcontroller based embedded system with various other peripherals like servo motor, DC motor and wireless camera[7].

The wireless IP camera does the surveillance and a mobile phone at the controlling side will stream the video continuously[1]. When an obstacle is found a call/message will be sent from the mobile phone at the transmitting side to the receiving side. When a specific operation has to be applied on the robot we will press the appropriate keys on the mobile phone at the transmitting side ,which will be decoded b the DTMF decoder ,this will be sent to the microcontroller Arduino mega 2560,which will give the command to the motor drivers. These motor drivers will send the signals to the motors .The motor will change as per the instructions.

IV. BUILDING THE ROBOT

3D modeling is the process of developing a mathematical representation of any surface of an object (either inanimate or living) in three dimensions via specialized software. The product is called a 3D model. It can be displayed as a two-dimensional image through a process called 3D rendering or used in a computer simulation of physical phenomena. The model can also be physically created using 3D printing devices.

In our project it is used as the chassis for the robot instead of other materials we are using 3D Printed design. It is also used for designing the body and the four arms of the robot.

V. HARDWARE IMPLEMENTATION

A.DTMF

In order to control the transformation of the robot remotely a mobile phone is used in transmitter side, firstly a call will be made to the receiver phone and then attend the call manually or automatic answer[2]. Due to the DTMF function of the phone when a particular button of mobile keypad produces specific DTMF tone that will transmit by the operator of mobile to the control system. There will be another mobile phone connected to the DTMF decoder .The DTMF signal sent from the transmitter mobile will be decoded by the DTMF decoder ,it will decode the tone into digit signal of 4bit.The arduino reads this commands sent by the DTMF decoder and compare with define code or pattern[5].

B. DTMF Encoding and Decoding

A DTMF keypad consists of a matrix of sixteen push buttons organized in four rows by four columns. Each button, when pressed generates a pair of tones. The tones belong to two groups, a low frequency group [697 to 941 Hz] and a high frequency group [1209 to 1633 Hz][2].

	1209Hz	1336Hz	1477Hz	1633Hz
697Hz	1	2	3	A
770Hz	4	5	6	B
852Hz	7	8	9	C
941Hz	*	0	#	D

Figure: Mapping of Frequency with keys [5]

These tones are converted to digital form using DTMF decoder circuit. These codes are the address of the destination which is read and preceded by the computer that connects the caller to

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the destination. The frequencies were selected so no one would be a harmonic of another DTMF frequency [2].

VI. APPLICATION AND ADVANTAGES

The applications of the project are Military applications, Surveillance, Rescue operations, Medical applications etc. The proposed robot can do surveillance around areas which is in need of security, areas like boundaries which need to be protected and prone to danger. This feature enables the robot to be used in Militaries[4]. The robot can also be used for rescue purpose as it can change its shape in accordance with the incoming obstacles. So this robot will be able to move through areas having rough surfaces and tiny spaces.

The advantages of the project if it is developed can be highlighted as follows:

1. This robot is capable of performing multi-tasks without much human interventions.

2. It can carry out rescue operations in areas where human cannot reach easily.

3. It can perform surveillance around areas of boundaries for monitoring of any illegal or suspicious activities inclusions or ceasefires violations

VII. EXPERIMENTAL RESULT

In the proposed work DTMF signal has been generated by pressing the keys on the user mobile phone key pad and the decoded output corresponding to the key pressed[8]. DTMF signals from 12 different keys on the user mobile key pad have been used to generate the desired changes in the motors. The older version phones like Nokia 1100, Nokia 2300 were found to be more appropriate for the purpose. The proposed robot's main objective was to do continuous surveillance along with making changes in the shape. The IP camera used here does the surveillance and it stream to the user mobile phone. When an obstacle is being found ,immediately the user will press the necessary key on the mobile phone and which is received and decoded ,this is sent to the arduino. The arduino will send it to the motor drivers, which in turn transmits to the motor. Hence the motor does the changes.

VIII. CONCLUSION AND FUTURE SCOPE

Surveillance is increasingly becoming one of the most important subjects when it comes to security. In this work we have aimed to design a portable, economically viable system which will find application in Military and Civilian sectors[4]. Through the implementation of the concept of Self Transforming Robot, the system will be able to spy in areas which are in need of security using the help of Wi-Fi camera, which will stream videos to the control system using Wi-Fi[1]. And it also works on un-even surfaces by changing its shape, for this we use DTMF module which in turn will help to change its direction and shape as well[2]. A metal detector is used to detect explosives.

The robotics is a progressive sector in the current era of electronics. In the future, most of the jobs done by the humans may be replaced by the robots. Here in this project the robot is able to solve certain problems which human cannot solve.

Since the Indian government is also spending more amounts for robots which can help in military applications, the proposed robot is having high importance. In the future the robot can be used for bigger purposes. It can be used to do spying operations even during night for catching terrorist, it can be used for bomb detection and bomb defusal as well. Our robot is manually transformed but in the future we can enable it to perform automatic transformation. With more modification it can also be used for carrying human beings, the current society is in need of robots which can help them for rescue operations.

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