

## Hexapod Bluetooth Control Robot in Hostile Environment

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### ABSTRACT

*The aim of the project is to build a six legs walking robot that is efficient to perform basic moving tasks such as walking forward, backward, rotating in place and raising or lowering the body height. The robot will serve as a platform onto which additional sensory components are added, or which would be programmed to perform increasingly complex motions. In comparison to the previous gadgets this robot can be used to carry various fire prevention gas cans like carbon dioxide can to reduce the excess fire at the disaster terrain, first aid medical kit for the injured humans etc. Special attention is towards the hostile environment where the human intervention is restricted.*

**Keywords:** Hostile environment, Hexapod, Human intervention, Arduino, disaster terrains.

### I. INTRODUCTION

Hexapod robot is a robot which has six legs for walking mechanism in different directions. A robot can be even stable on four or more number of legs. But a hexapod robot comes with six legs which provide a tremendously good stability and flexibility of how it can be operated in different directions. While robot is working if some leg gets disabled the robot may still be able to walk in various different directions. The hexapod robot can be programmed in a way to move in different directions like forward, backward, rotate to left side, rotate to right side, raising its body. Hexapod robot can help to reduce risk of life to humans, as it can easily walk through various hostile environment. More acceptable number of legs and the ability to move in different directions provide more controlled balance to the robot when compared to the majority of other multi-legged robots [9], which makes this robot work tremendously even at hostile environment where human intervention is strictly prohibited. A wheeled robot can move faster on some well levelled ground than a legged robot, hexapod robot is the fastest of the legged robots just because it has six legs to walk and balance in various directions. The required number of legs for walking speed studies have shown that a more number of legs do not increase walking speed [8]. We can look at the control point of view where a simplest walking robot uses six legs which allows to implement a mechanism that lifts up and reposition three legs of the robot and uses other three legs to remain on the ground to provide a stable balance to the robot. The most common application of this robot on which we are stressing is to make it work in hostile environment like disaster terrains, fire in forest, fire in building, war zones etc. The robot can also be used to keep track of irrigation valves at the farmer's fields, which can help to prevent over watering of crop. The robot can open and close valves with the help of human commands via voice, remote etc. Observing the movement of animals and insects plays a vital role in formulating a structure a six leg movement [5]. The movement of six legs insects helped a lot in understanding the walking mechanism of the robot.

### II. RELATED WORK

Through various IEEE research papers, general papers and various other research articles make it evident that in order to build such a robot that can walk smoothly and effortlessly through a rough terrain many works have been done previously.

2.1 Out of the various significant works the MorpHex Hexapod Robot in 2011 [1] has a very good flexible movement of the legs and the robot was designed using a 3D printer. Another important work which helped us in understanding walking mechanism of the robot is Walknet where the authors observed the movement mechanism of the animals and insects successfully made a structure for a six legs walking robot [5].

2.2 Keeping lives in danger at various hostile environment due to the lack of life saving or first aid accessories is a matter of concern which gave us the motivation of this paper [3]. Another studies about the life saving

robot of Korea had a great impact on this proposed hexapod robot [4]. Another work has been studied during year 2011 [6] where in order to observe and monitor predicament situations of a hostile area they used a satellite to identify various conditions of the affected area.

2.3 One another robot have developed during the year 2012 named RHex which was developed using completely different hardware components as mentioned by the authors that they have used brushed DC motor [2]. The motors they have used at this robot are Mason type motor with a 33:1 gearhead powered by a 24V NiMH battery. The authors stated that this method is easy to design and manufacture, they even stated that the maintenance of the robot is quite easy and cheap. They have mentioned that this design is more suitable for stair climbing.

2.4 Another work related to hexapod robot is a Bill-Ant-P robot has been made using aluminium and carbon fibre sheets [7] which helps robot to be very light weight and easy to carry. They have used MPI MX-450HP hobby motors for movement and high torque. The motor they used has 8.37kg-cm of torque which can rotate about 60 degrees in 0.18sec.

### III. PROPOSED WORK

#### 3.1 WORKING OF ROBOT

As compare to previous work as mentioned above in related work we have made a hexapod robot which will be use to have a look at the hostile environment where the human intervention is restricted. The robot is mounted with a OV7670 camera module (Wi-Fi enabled) which makes robot to provide a real time pictures on smart phone. The heart of the robot is Arduino mega which acts like main processing board of the robot as shown in fig (3.1). Arduino mega will receive commands from humans (voice or with a remote) with the help of a HC-05 Bluetooth module. This Bluetooth module is connected to a smart phone application which can provide commands to robot and Arduino is going to receive command and make robot work according to the commands provided. Another important component is Adafruit 16 channel PWM shield which is used to drive and control 12 servo motors used in robot for movement of legs as shown in fig (3.2). We have used one ultrasonic sensor which is mounted on the robot to avoid movement of robot due to any obstacles in front of the robot. Robot is programmed in a way to move in different directions like moving forward, backward, rotating left, rotating right and lowering and raising the body of robot. Arduino IDE software is used to dump the code written in C/C++ language, these all various hardware and software components have been listed in table (4.1). We have used 6V Li-ion battery for an efficient power backup to the robot.

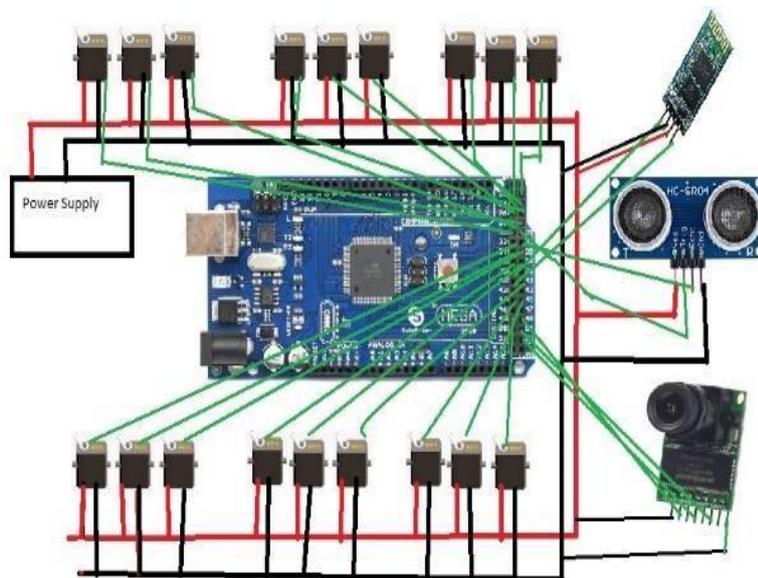


Fig: 3.1 circuit diagram of robot

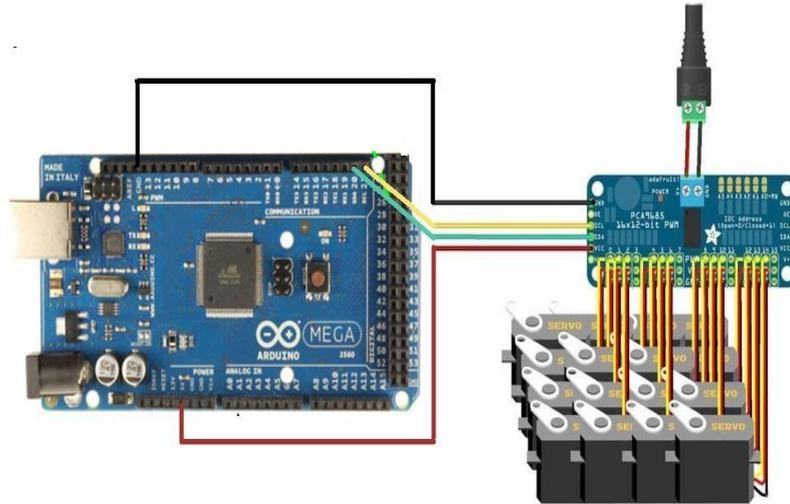


Fig: 3.2 circuit diagram of servo motor driving unit

#### IV. HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE REQUIREMENT	SOFTWARE REQUIREMENT
<p><b>Arduino UNO/Mega</b>  <b>Adafruit 16-channel PWM Shield</b>  <b>12 micro servos with metal gears (MG90S or equivalent)</b>  <b>4.8 or 6 V Battery (NiMH, Li-ion etc.)</b>  <b>M3 bolts + nuts and washers</b>  <b>HC-SR04 Ultrasonic ranging module</b>  <b>OV7670 Camera Module</b>  <b>HC-05Bluetooth module</b></p>	<p><b>Arduino IDE</b></p>

Table:4.1 List of hardware components and software

#### V. CONCLUSION

We have proposed a hexapod six legs robot that would be able to operate in hostile environment where human intervention is prohibited. The movement of the robot have been tested accurately and has a great efficiency as compared to other types of robots. To control this robot, we have used Arduino as the major hardware components. This robot can be used in various hostile environment reducing the risk of human life. It can be used in agriculture fields as well to control the water flow, by adjusting the water valves optimally and thereby saving water resources, the robot has worked tremendously well in hazardous situations such as operating in hostile environment, disasters terrains like fire in the forest, at the crop fields, taking various rescue components like first aid box, carbon dioxide gas can to reduce excess fire etc. It is hoped that a little more amount of work would allow our proposed system to work in real life scenario and reduces excess risk to human life.

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