Autonomous Home Automated Hexapod Robot

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***Abstract*: This paper focuses on design and implementation of six legged robot that is capable of monitoring and performing house hold works independently. The Autonomous Home Automated Hexapod is developed with three AT89C52 microcontrollers which functions as brain of the robot to which all operating functions of each module are chronologically programmed in it. The legs of the robot were developed with 2 servo motors to provide two degree for each leg. Several additional sensors like TSOP1738 (IR), RF transmitter and receiver, DS1307 (Real Time Clock) have been embedded into robot in modular form to make it work autonomously.**

Key words: Six legged Robot, MicrocontrollerAT89C52

I INTRODUCTION

Nowadays, autonomous robots are in demand because of their capability of making numerous activities not only easier but also efficiently. These robots require minimal human intervention to do their job.

Wheeled robots through easier to design as well as control are not very able to traversing in rough terrain because of the requirement of sophisticated suspension system as well as traction control .which give rise to various control complexities .

After deciding on legged robot we had the choice of quadruped, octaped or a hexapod .we decided on the hexapod because of the compromise between extra stability of octaped and maneuverability of quadruped.

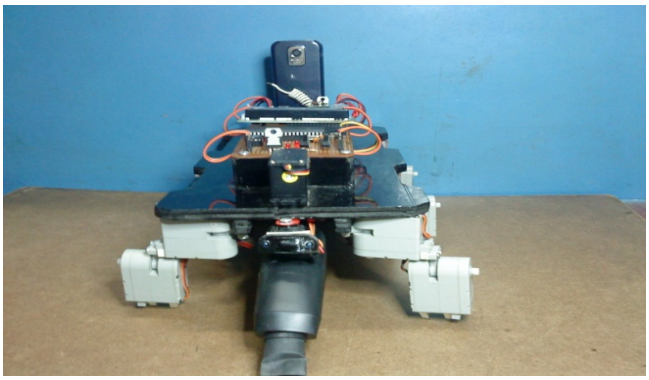


Fig .1 Autonomous Hexapod Robot

The Autonomous home automated hexapod is capable of traversing in rough terrain by maintaining its stability. A real time clock DS1307 is interfaced to hexapod which makes it function for a definite time by the user .The hexapod is enhanced with modules like Blower RF transmitter and receiver circuit and web-came which are used for cleaning, updating the system status and monitoring purpose respectively.

II DESIGN CONSEDERATIONS

System Structure: The Autonomous home automated hexapod robot deign is divided in to two subsystems they are 1.Electronic subsystem and 2.Mechanical subsystem

The electronic subsystem is further divided into four categories they are (a) Three AT89C52 microcontrollers. (b)DS1307 Real-Time Clock. (c)TSOP1738 IR transmitter and receiver (d) RF transmitter and receiver. The functioning of each category is explained below.

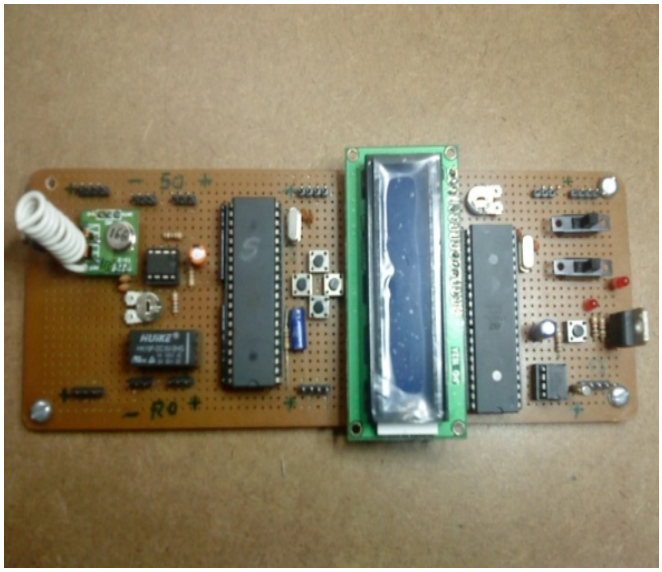


Fig. 2 Main circuit board

The three AT89C52 microcontrollers are named M1, M2 and M3 respectively.

The job of M1 is it is inter faced to real time clock DS1307 with I2C protocol .the user has four switches by which he can enter the day, date and time at which the robot has to start functioning and also stop functioning .It is displayed on LCD monitor which is inter interfaced to M1.

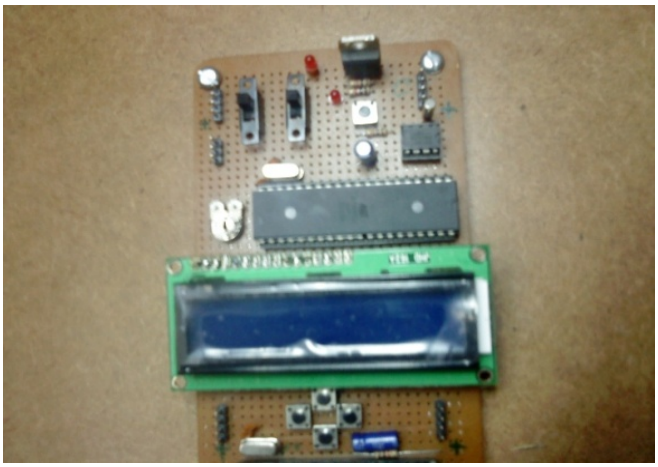


Fig 3 Interfaces to Microcontroller M1

The job of M2 is make the servo motors to run which will make the leg movement .The IR sensor TSOP1738 circuit is also interfaced to M2 through which it detect any obstacle in front of its motion and will take diversion in its path according to interrupt in sensor circuitry, it will also transmit the status of the robot through RF transmitter i.e. whether the robot started working or stopped working, it in turn contains blower through which it will clean the surface of the floor.

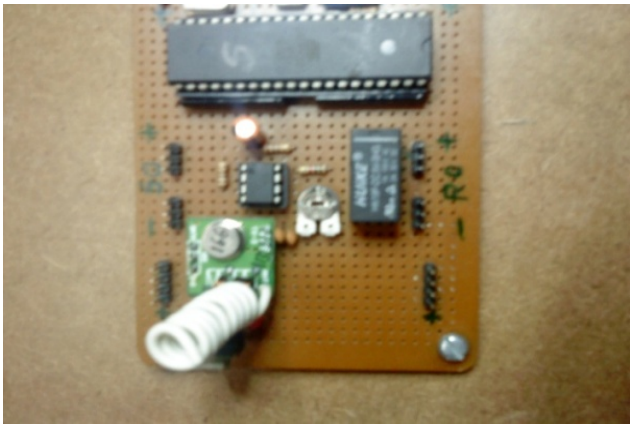


Fig 4 Interface Circuit to M2

The microcontroller M3 is used to receive data through RF receiver and displays .this makes the hexapod to view its status while operating in remote applications.

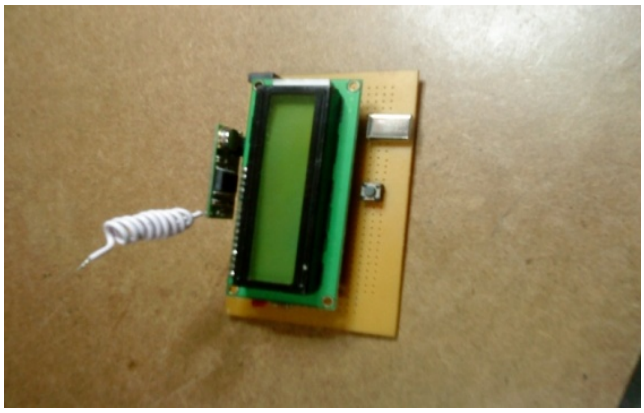


Fig 5 Microcontroller M3 with RF receiver

Additional sensory circuit can also be interfaced to hexapod Here we consider a web-came which will monitor the surroundings and transmit it to personal computer .In mechanical subsystem is categorized in to three types they are.(a)Chassis board (b)leg design (c)power supply design .In mechanical subsystem the first part is the designing of chassis board on which the total circuit has to be done .This is developed with light weight VCB sheet.

Fig 6 Bottom view of chassis board

The hexapod consists of six legs each leg is developed with two servo motors which provide two degree of freedom for each leg.

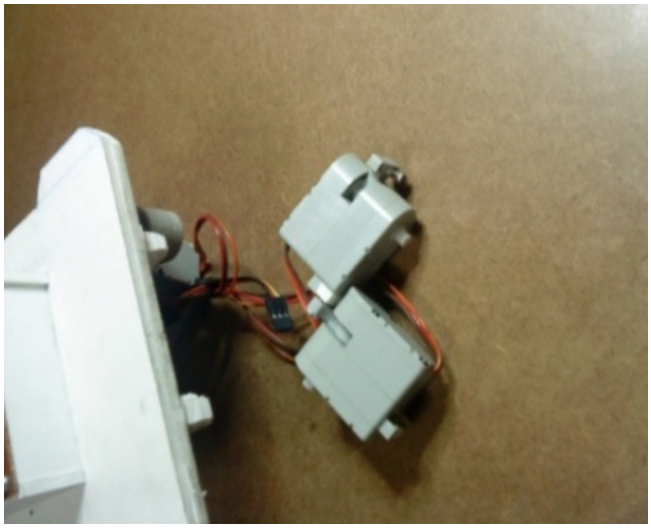


Fig 7 Leg design with two servos

The power supply is the critical part in robotic applications .Here the robot is supplied with totally seven rechargeable lithium ion batteries with 3.7volts and 1400milli amps each

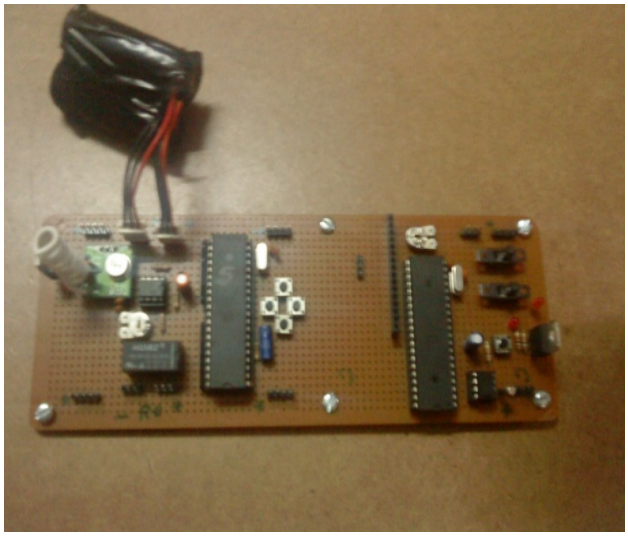


Fig 8 Power supply design

III ALGORITHM:

Step1: The user has to initiate microcontrollers M1, M2 and M3.

Step2: The required day, date, time and year at which the functionality of robot is given to microcontroller M1 through push button switches.

Step3:The microcontroller M1 will continuously monitor the present time with robot initialization time .If it is satisfied it goes to next stage else it waits in present state

Step4: An enable signal is sent to microcontroller M2 from microcontroller M1

Step5: Microcontroller M2 is activated

Step6: The microcontrollerM2 will performs the following operations

Step6.1. Initiate gait generation

Step6.2. Activate blower

Step6.3. Send the system status to microcontroller M3

Step7: The robot will check for any obstacles in the direction .If any obstacle is detected it will go to step8 else it goes to step9

Step8: Take diversion in the path it travelling and goes to step9

Step9: Continue to perform operations

Step10: The microcontroller M2 will check for stop time matches with present time if it is matched it will go to step9 else it will go to step11

Step11: Stop all the activities of Robot and inform the status to microcontroller M3

The software's used for programming is Keil IDE v3.1 ,the simulation of the program is done several times on Proteus7.6 sp3 before going on to hardware development .

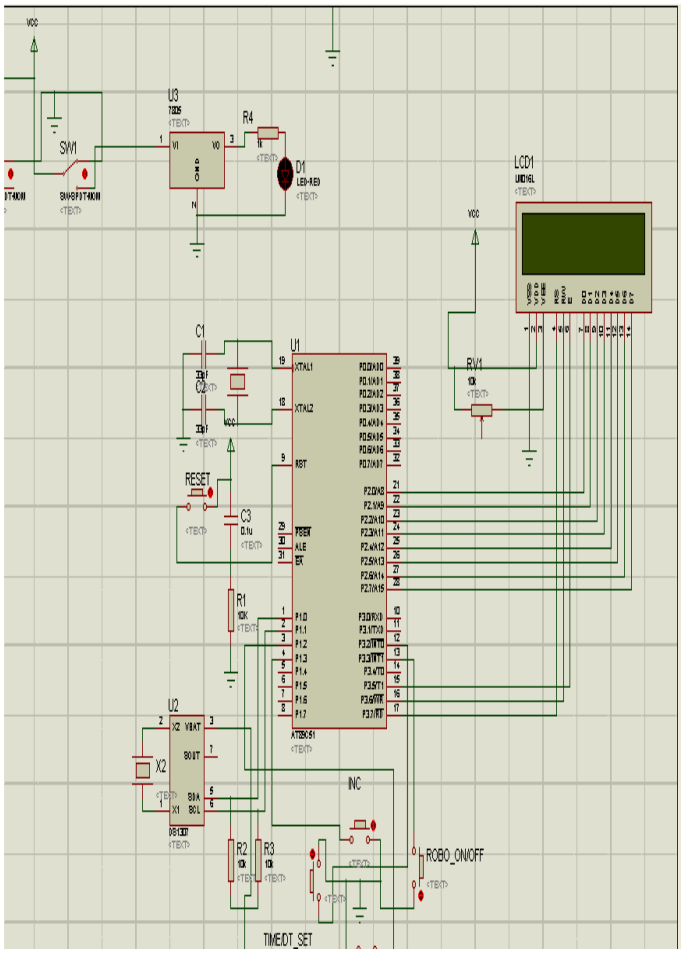
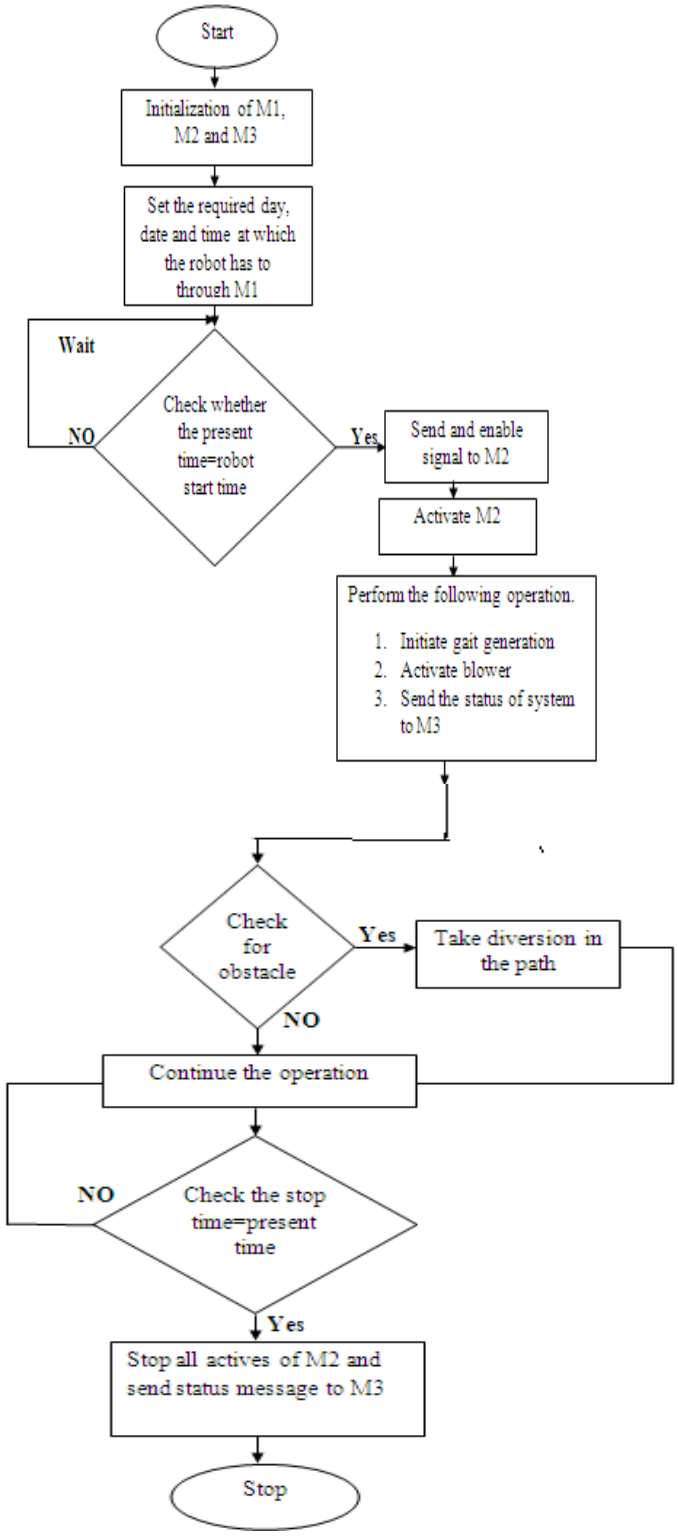


Fig.9 Simulation work on Proteus7.6

IV SYSTEM FLOWCHART:



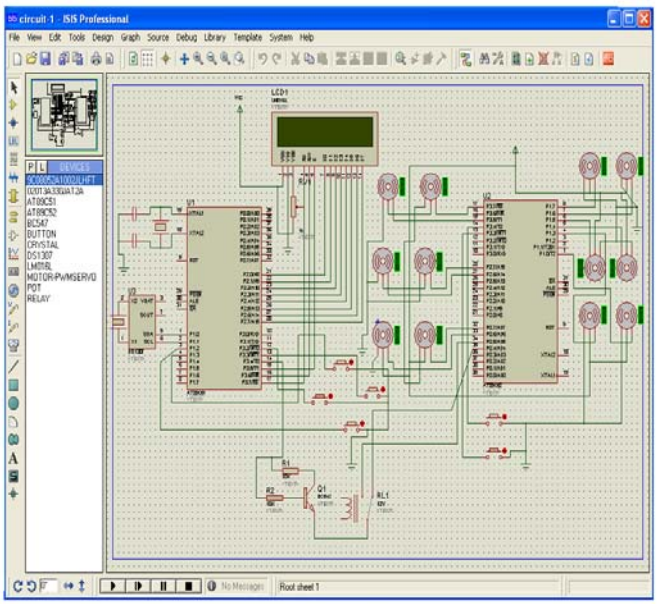


Fig.10 Simulation work on Proteus7.6

V CONCLUSION:

The autonomous home automated hexapod robot was tested by giving a start and stop time through DS1307(Real Time Clock)to microcontroller M1 at the exact start time the microcontroller M2 is activated which make the legs of robot move .the TSOP1738 IR circuit attached to M2 is detecting and taking diversion in its path .The blower attached to the M2is picking small dust particles on the surface floor .The RF transmitter and receiver are communicating and the status of the robot is displayed on lcd of M3.

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