

# DESIGN AND DEVELOPMENT OF TOUCH SCREEN CONTROLLED STAIRS CLIMBING ROBOT

Rammilan Putan Parasram<sup>1</sup>, Nilesh Bodne<sup>2</sup>

<sup>1</sup>MTEch, Department of Electronics and Communication, Vidarbha Institute of Technology, Nagpur

<sup>2</sup>Assistant Professor (MTEch. ECE), Vidarbha Institute of Technology, Nagpur

## Abstract

This paper presents a method of developing a stairs climbing robot with self balancing chair mounted on the top of the robot. It is one of the major task in the field of Mechatronics require a mechanical arrangement and electronics based control of the actuators using wireless technology. In most of the mechanism it is hard to maintain the slope position of the seat while carrying some goods on it, so taking in action all these condition the robot is to design and develop [1] which will climb on the stairs and adjust themselves as per environmental condition.

**Keywords:-** Accelerometer, CC2500, Touch Screen, Microcontroller, Relays

\*\*\*

## 1. INTRODUCTION

The system is basically based on mechatronics used for developing a stair climbing robot with self adjustable attached seat on it based on MEMS (Micro Electro Mechanical System), CC2500 transceiver and Touchscreen. It is really one of the advance and necessary technology which will be implemented everywhere in future.

It is based on the Microcontroller-ATMega16 and wireless communication using CC2500-Transceiver and Touchscreen. The intelligence for controlling the robot will be embedded on the [6] AVR series microcontroller i.e.ATMega16. It will be programmed by using embedded 'C' Language.

For self balancing of the seat designed will be controlled using accelerometer ADXL335 providing a good range of analog value of different calibration as per the co-ordinates.

## 2. LITERATURE

Robots have wide history of being in use ever since industrialization. There has been and ever growing development in the field which noted in the several records .In 1938-39 the jointed mechanical arm was invented for spray painting. When, in 1954 George C. Devol filed a U.S. patent for a programmable method for transferring the article between different parts of a factory, he wrote: “

The present invention makes available for the first time a more or less general purpose machine that has universal application to a vast diversity of application where cyclic control is desired.” In 1957, cam programmable “pick and place”, robot was developed by Brown, at the planet corporation in the USA. In 1967-68 the first wheeled walking machine using vision and other sensors, were reported. In 1974, the first servomotor actuated and microcomputer

controlled robot were commercially launched and they were used by NASA to collect samples from the surface of mars.

In 1981, a microprocessor-based pneumatically operated pick and place Robot was indigenously developed by the author S.R.DEB in the Production Engineering Department at Jadavpur University. In 1984, Bhabha Atomic Research Central has developed a 6-axes multipurpose Robot, having weight about 300kg and can move an end-of-arm, load of 10kg, including that of end effector.

According to Robert J. Schilling the robot manipulation has been read and studied in detail, the various drive technologies, work envelop of every configuration that has so far been developed the SCARA, jointed arm configuration, the various robot specification like number of axes, capacity by and speed, torque and force analysis has been done.

According to Edwine Wise the robot comprises of components belonging to several fields like electronic components it became essential to study in depth about electronic components like sensors, PCB making, microprocessors and making of driver circuits was taken in depth from several sources.

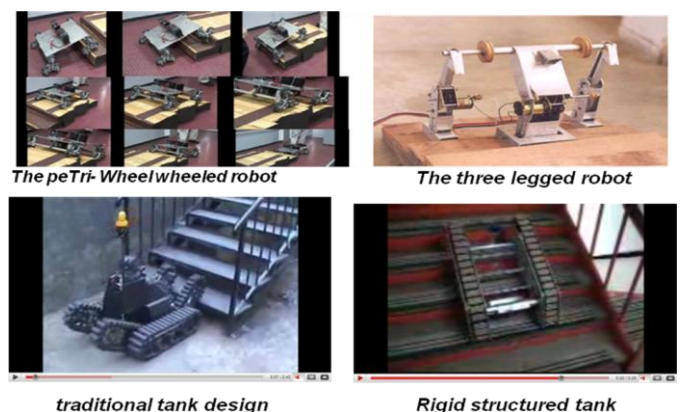


Fig: 1



Fig. 2 Developed Model

### 3. BLOCK DIAGRAM

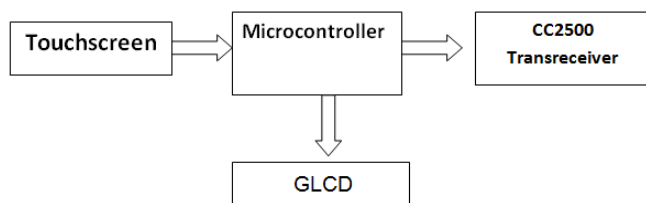


Fig. 3 Transmitter

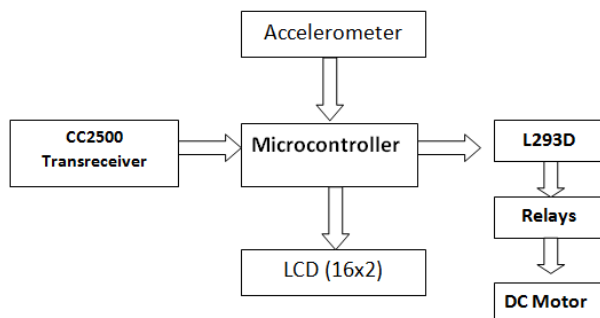


Fig. 4 Receiver

Fig.3.shows complete block diagram of the working of controlling unit using touchscreen module interfaced with microcontroller and data will be transmitted using CC2500 Transceiver module. Whereas Fig.4 shows the receiver end which is consisting of a CC2500 Transceiver module connected to the microcontroller ATmega16 for serial Receiving of data. The microcontroller will process the signal and control the mechanism of the robot as per the [3] algorithm embedded on it. The [7] accelerometer consisting of three axis movement recognition, in a co-ordinate of x, y and z axis, but we are using only two of them x and y. for seat adjustment surmounted on the top of the robot as per the fig 2.

### 4. FLOW OF THE SYSTEM

The implementation of the proposed system is shown in fig. 5. As per the flow chart, first we are initialing the sensor variables, then wireless initialization will be done for receiving the data from the [4] transmission end. As per the condition received it will be further processed by the decision and control system for controlling the robot as well as balancing its seat attached on the top of the robot.

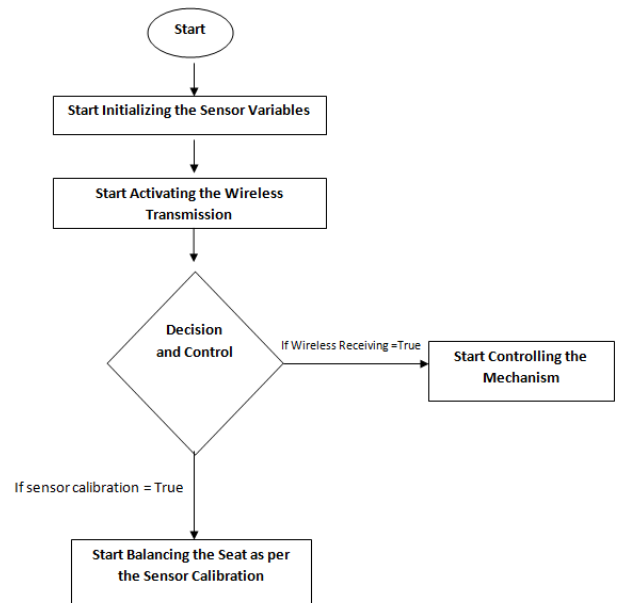


Fig 5 Flowchart for the Model

### 5. TECHNOLOGY USED

In the above model, I have used CC2500 Transceiver Module for data communication, whereas Microcontroller ATmega16 is used for processing the signal and Accelerometer is used for self balancing the seat attached on the system. The major components are given below.

- 1) ATmega16 Microcontroller
- 2) CC2500 Transceiver Module
- 3) LCD-16x2 Display
- 4) GLCD
- 5) Motor Driver L293D
- 6) DC Motor -200RPM
- 7) Metallic Chassis
- 8) Track belts
- 9) DC Battery
- 10) Accelerometer ADXL335
- 11) Touch Screen

#### 5.1 What is a Touch Screen?

A touchscreen is any monitor, based either on LCD (Liquid Crystal Display) or CRT (Cathode Ray Tube) technology, that accepts direct onscreen input. The ability for direct onscreen input is facilitated by an external (light pen) or an internal device (touch overlay and controller) that relays the X,Y coordinates to the computer.

#### 5.2 Resistive Touchscreen Technology

Resistive LCD touchscreen monitors rely on a touch overlay, which is composed of a flexible top layer and a rigid bottom layer separated by insulating dots, attached to a touchscreen controller. The inside surface of each of the two layers is coated with a transparent metal oxide coating (ITO) that facilitates a gradient across each layer when voltage is applied. Pressing the flexible top sheet creates electrical

contact between the resistive layers, producing a switch closing in the circuit. The control electronics alternate voltage between the layers and pass the resulting X and Y touch coordinates to the touchscreen controller. The touchscreen controller data is then passed on to the computer operating system for processing.

### 5.3 GLCD



Fig: 6

- This LCD module uses a 128x64 liquid crystal display that support Chinese character , English characters and even graphics. It is suitable for interactive work with Adriano. It features a backlight control, parallel or serial control, contrast adjust. It can be connect to our interface shield via IDC6 socket and cables.
- The LCD is shipped in Parallel mode in default. The R9 is used to set the interface mode. To switch to SPI mode, the R9 resistor need to be moved to R10

### 5.4 Microcontroller

The purpose of using AVR AT Mega microcontroller is its advantage of having inbuilt analog to digital converter (ADC) which are required to obtain feedback from the sensors.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock

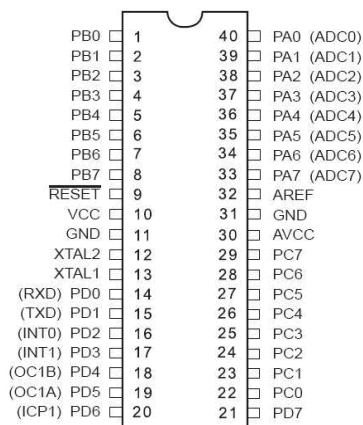


Fig: 7

### 5.5 CC2500 Transceiver

- Sensor Networks / Data collection.
- Wireless metering.
- Access control / Identity discrimination.
- Home Automation.
- Smart house products / Security Systems.
- Remote control / Remote measurement system.
- Weather stations.
- Multi Slave Communication.
- Up to 250 Device can communicate with each other.

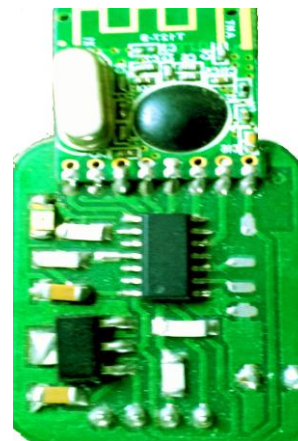


Fig: 8

### 5.6 Accelerometer



Fig: 9

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

### 6. CONCLUSION

As per the proposed model, I have successfully completed the design and development of the stair climbing robot which can climbing very easily on stairs by balancing its chair attached on the system. The accelerometer attached with the circuit

will define the analog values calibration for its balancing nature where as [10]CC2500 Transreceiver Module is the perfect hardware module for wireless communication network between transmitter and the receiver module. The mechanically designed and fabricated model is providing a good rigid structure for carrying the material from one place to other. Its controlling unit work on [9] RISC structure, which will provide fast execution of the program embedded on it. Overall the developed model is working smoothly as per my research work.

## REFERENCES

- [1]. S. Guo, T. Fukuda, and K. Asaka, "A new type of fish-like underwater microrobot," in *IEEE/ASME Trans. Mechatron.*, vol. 8, Mar. 2003, pp. 136–141.
- [2]. S. Guo, T. Fukuda, and K. Asaka, "Development of Underwater Microrobot Using ICPF Actuator," in *Int. Conf. of Robotics and automation*, pp. 1829-1834, 1998.
- [3]. S. Guo, T. Fukuda, and K. Asaka, "Fish-like Underwater Microrobot with Multi DOF," in *Int. Symp. on MICROMECHATRONICS AND HUMAN SCIENCE*, pp.63-68,2001.
- [4]. Fukuda, Kawamoto, Arai and Matsuura, "Mechanism and Swimming Experiment of Micro Mobile Robot in Water", Proc. IEEE Con. on Robotics and Automation, Vol.1, pp.814-819, San Diego, California, May 1994.
- [5]. Fukuda, Kawamoto, Arai and Matsuura, "Mechanism and Swimming Experiment of Micro Mobile Robot in Water", Proc. IEEE Con. on Robotics and Automation, Vol.1, pp.814-819, San Diego, California, May 1995..
- [6]. <http://www.atmel.com/products/microcontrollers/avr/>
- [7]. Fukuda, Kawamoto, Arai and Matsuura, "Steering Mechanism of Micro Mobile Robot", Proc. 1995 IEEE Con. on Robotics and Automation, Vol.1, pp.363-368, Nagoya, Japan, May.
- [8]. Junzhi Yu, Min Tan, Shuo Wang, "Development of a Biomimetic Robots and Its Control Algorithm," in *IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS*, VOL. 34, NO. 4, AUGUST 2004.
- [9]. Michael G. Borgen, Gregory N. Washington, and Gary L. Kinzel, "Design and Evolution of a Piezoelectrically Actuated Miniature Swimming Vehicle," in *IEEE/ASME TRANSACTIONS ON MECHATRONICS*, VOL. 8, NO. 1, MARCH 2003.
- [10]. <http://developer.android.com/about/index.html>