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# Data Acquisition of Foot Palm Pressure

**Chinmay Sonambekar[1], Nitesh Jhavar[2],Advait Paltewar[3] ,Shubho Roy Choudhary[4],Ronak Chougule [5]**

*[1]Mechanical Engineering Department, Vishwakarma Institute of Technology*
*[2]Mechanical Engineering Department, Vishwakarma Institute of Technology*
*[3]Mechanical Engineering Department, Vishwakarma Institute of Technology*
*[4]Mechanical Engineering Department, Vishwakarma Institute of Technology*
*[5]Mechanical Engineering Department, Vishwakarma Institute of Technology*

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**Abstract -** Foot plantar pressure is the pressure field that acts between the foot and the support surface during everyday locomotor activities. Information derived from pressure measures is important in gait and posture research for diagnosing lower limb problems, footwear design, sport biomechanics, injury prevention and other applications. In this paper, an Arduino equipped with Force Sensing Resistors (FSR) is developed to measure plantar pressure. The sensors proved its high accuracy and reliability for measuring high pressure distributions under the foot in real time. The sensed data are collected and transferred to Arduino. This later displays in real time the data on an Excel Sheet. Even real time graph is displayed for comparison.

***Key Words***: Foot Pressure, Force Sensing Resistance

## 1.INTRODUCTION

The foot is the terminal link of the kinematic chain in human locomotion. During standing the foot assists in the control of the delicate muscular activity that is needed to keep balance. The functions of the foot during walking are twofold. A passive function, providing a first stage of cushioning of the impact forces the human body is subjected to during walking and running and an active function, transferring the internal forces produced by the muscles to the ground in order to accelerate the body during push-off. According to Newton's third law action equals reaction. During walking interactive forces are transferred between the human body and the ground. The use of force platforms is the method most commonly used to assess the interaction of the foot and supporting surface. Although the force platform provides valuable information regarding both the vertical and shear components of the ground reaction force, it provides little information on how the planter surface of the foot is loaded with respect to the supporting surface. When evaluating patients, a typical amount of loading or patterns of loading may be reflective of a systemic or localized lower-extremity pathology and may be indicators (risk factors) for or predictors of further pathology or worsening of the existing pathology. In addition, the force platforms are designed for accurate aim, and they have very specific requirements for attachment to the supporting surface on which data collection will occur. Such is not the case currently with the development of solutions for mobile systems and miniature circuits, lightweight, and energy efficient circuit solutions for healthcare sensor applications is an increasingly important research focus given in measurement instrumentation and healthcare monitoring, microfabrication processes. The need for medical equipment's market has attracted considerable attention by researchers in the field of biomedical instrumentation and biomechanics for this analysis of plantar pressure distribution to reveal the interface pressure between the surface of the foot and sole of shoe, for the design of shoes, ankle rehabilitation for sports injuries, improving balance control, a postural stability analysis, may help to reduce the risk of ulcer recurrence in patients with diabetes.

## 2. Problem Definition

Feet provide the primary surface of interaction with the environment during locomotion. Thus, it is important to Diagnose foot problems at an early stage for injury prevention, Risk management and general wellbeing, One approach to measuring foot health, Improvement in balance in sports and biomedical applications Notable applications in sport are soccer balance training and forefoot, loading during running, Prevent gait instability in the elderly and other balance impaired individuals.

## 3. Project Scope

Propose a device which will reduce the effort of the orthopedic surgeon by measuring foot palm pressure and analyzing them with standard results.

## 4.Design

A.Pressure acquisition system:
In order to measure the pressure of the foot, we have developed a sole. This later is equipped with pressure sensors (FSRs in our case).
1.Pressure Area
To find pressure areas in high foot with contact with the soil, we had contacted Dr. Vaidya and with reference to his knowledge and requirements we have determined various pressure points on foot as shown.

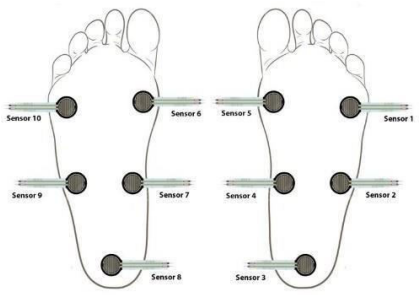


**Fig-1:** Pressure point on foot

2.Sensing Element

We used an Interlink Electronics FSR 402 model, it has a single-zone Force Sensing Resistor, with interesting characteristics well light weight, small size and low cost, optimized for use in human touch control of electronic devices such as automotive electronics, medical systems, and in industrial and robotics applications. They are robust polymer thick film (PTF) sensors that exhibit a decrease in resistance with increase in force applied to the surface of the sensor. It has a 14.7mm diameter active area, we have placed an epoxy dome over the sensing area for directing all the applied force through the effective sensing area as shown in Figure.

**Fig- 2:** Force Sensitive Sensor (FSR)

B. Processing Unit

1. Arduino Mega

After conditioning the signal from sensors FSRs, the analogue to digital conversion can be made using the ADC module of open source microcontroller board based on the Microchip . The board is equipped with sets of digital and analogue input/output pins that may be interfaced to various expansion boards and other circuits. It can be powered by external 9 volts battery or by USB cable.

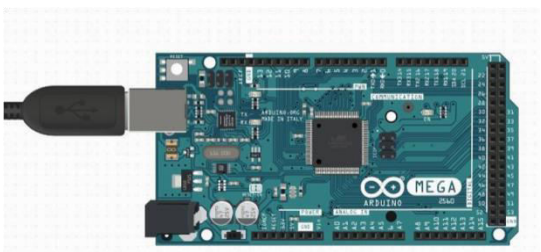


**Fig-3:** Arduino Mega

2.PLX-DAQ

Parallax Data Acquisition tool software is an add-in for Microsoft Excel acquires up to 26 channels of data from any Parallel microcontroller and drops the numbers into columns. It provides easy spread sheet analysis of data collected in the field, laboratory analysis of sensors and real time equipment monitoring.


**Fig-4:** PLX-DAQ

## 4.COMPONENTS

**Table- 1**: List of Component

| **Material** | **Quantity (Nos)** |
|---|---|
| Force Sensor | 10 |
| Arduino Mega Board | 1 |
| Bread Board | 1 |
| Resistor | 10 |
| Data Cable | 1 |
| Jumping Cable | As per requirement |

## 5.METHODOLOGY

1.Output voltage (FSR Voltage) of force resistor sensors are acquired via Arduino (analogue pins from A1 to A10) board.
2.Using an Integrated Development Environment (Arduino IDE) the acquired voltage is converted into equivalent force for respective sensors.
3.To store, display as well as compare foot pressure we require a datasheet.
4.To create a datasheet, we need an interface between IDE and excel.
5.PLX-DAQ is used to store, display as well as plot a real time graph of the obtained values.

## 6.CONNECTION

The circuit is mounted on bread board as shown in Figure. It consists of 5 parallel sensors connected in series to 10-ohm Ω resistors each to Arduino Mega.

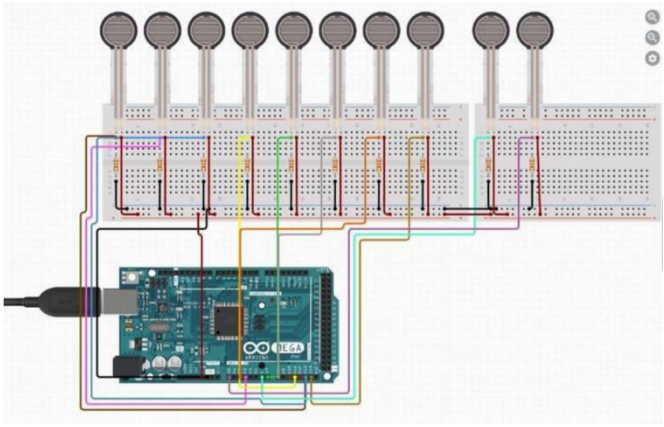

**Fig-5**: Circuit Diagram

## CONCLUSIONS

We have presented in this paper, a system to record and analyze foot pressure distribution. From the experimental results, it can conclude that purpose of measuring the pressure of the foot is to quantify the degree of deformation of the foot and foot dynamically evaluate and define areas of high pressure.

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