

DIGITAL SYSTEM FOR MEASURE DISTANCE BETWEEN TWO DEVICES, USING WI-FI RSSI.

P.G.H. Isuru*, Y.A.A. Kumarayapa

**Department of Electronics, Wayamba University of Sri Lanka, Kuliyaipitiya, Sri Lanka*

**heshan90gallage@gmail.com*

ABSTRACT

In this work we attempt to identify the distance between two mobile devices with the support of Wi-Fi. The Received Signal Strength Indication (RSSI) of Wi-Fi can be used to estimate distance between smart devices. The characteristic of Wi-Fi RSSI value is different with environmental changes. Here, we use received signal strength as a function of distance between the transmitter and receiving device. The aim of this project is to design mathematical model using this function and device to measure distance between two smart devices. Matlab software with curve fitting tool is used to design mathematical model. For device design we used arduino (atmega328 microprocessor) board and Wi-Fi module. This proposed system measure distance range of two devices with the use of mathematical modeling. Arduino language was is in coding to provide a efficient algorithm for carrying out proposed task.

Keywords: Distance between smart device, Received signal strength indication (RSSI), Curve fitting tool, Wi-Fi technology

1. INTRODUCTION

GPS (Global Positioning System) is a widely used and a very popular system for tracking devices and finding out the location of the devices in the outdoor locations. But it is not successful for indoor localization because of reflections of the signals due to walls and presence of furniture and various other factors causing signal attenuation inside a building^[1]. In here we try to work using Wi-Fi technology as Indoor wireless positioning system. Wi-Fi technology is a short distance wireless technology that is widely used. It provides low cost, short wireless communications, which can be used to construct fixed and mobile communication sets, making a variety of information devices within close range. Wi-

Fi technology works in the global generic 2.4 GHz (or 5 GHz) ISM (Industrial, Scientific and Medical) Frequency band, thereby eliminating the cost of spectrum licenses and barriers of country borders. The main parameter used in this project was the Received Signal Strength Indication of Wi-Fi technology. The propose device will be using mathematical model taking distance function of RSSI. From the propose design device we can measure distance between two smart devices with the uses of Wi-Fi technology.

2. EXPERIMENTAL

For the mathematical model, we have collected the data RSSI vs. distance. Some hardware equipments and software were used for this. In this study we have used one smart phone and Laptop support Wi-Fi technology as devices and WifiInfoView software was used to measure RSSI. From this system correct MAC address of device (e.g. smart phone) can be identified. Also it show quality of signal and frequency band of signal. By changing distance between two devices we identify variation between Wi-Fi received signal strength and distance.

From this data, the mathematical model was designed in order to calculate distances using RSSI. Curve fitting tool of Matlab was used for formulating mathematical model. This model will be used for measure distance from Wi-Fi RSSI.

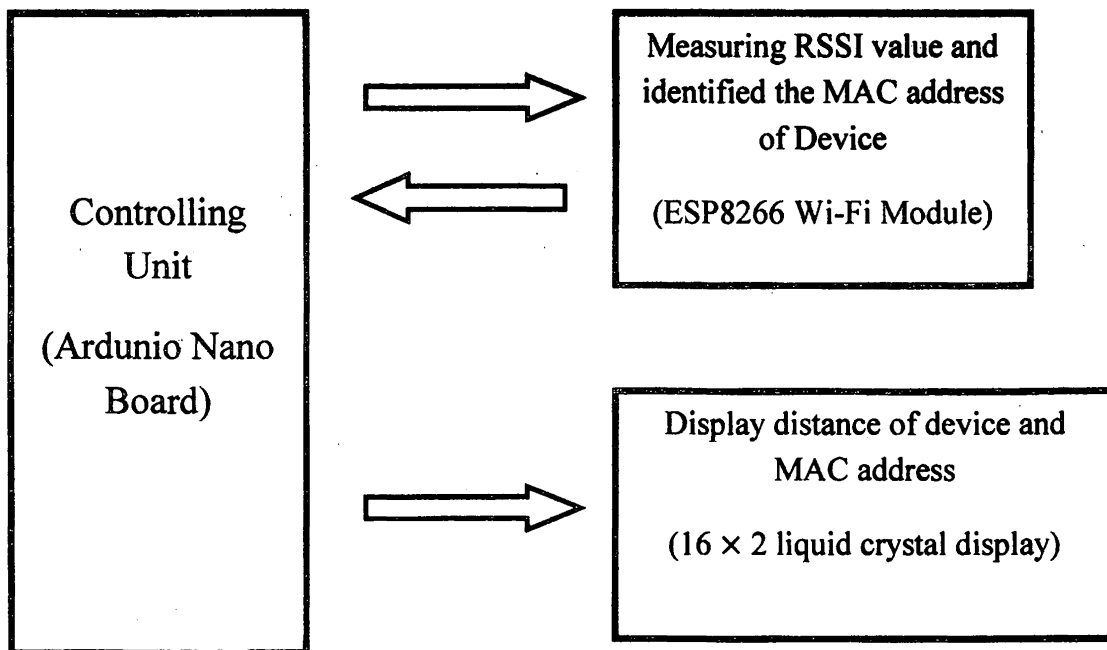


Figure 1: Block Diagram of the proposed system

ESP8266 Wi-Fi module used to identify the MAC address of other device and measure Wi-Fi RSSI. From the control unit we calculate distance using our equation and measured Wi-Fi RSSI. The calculate distance is displayed in LCD. Flow chart of the system can be shown as below.

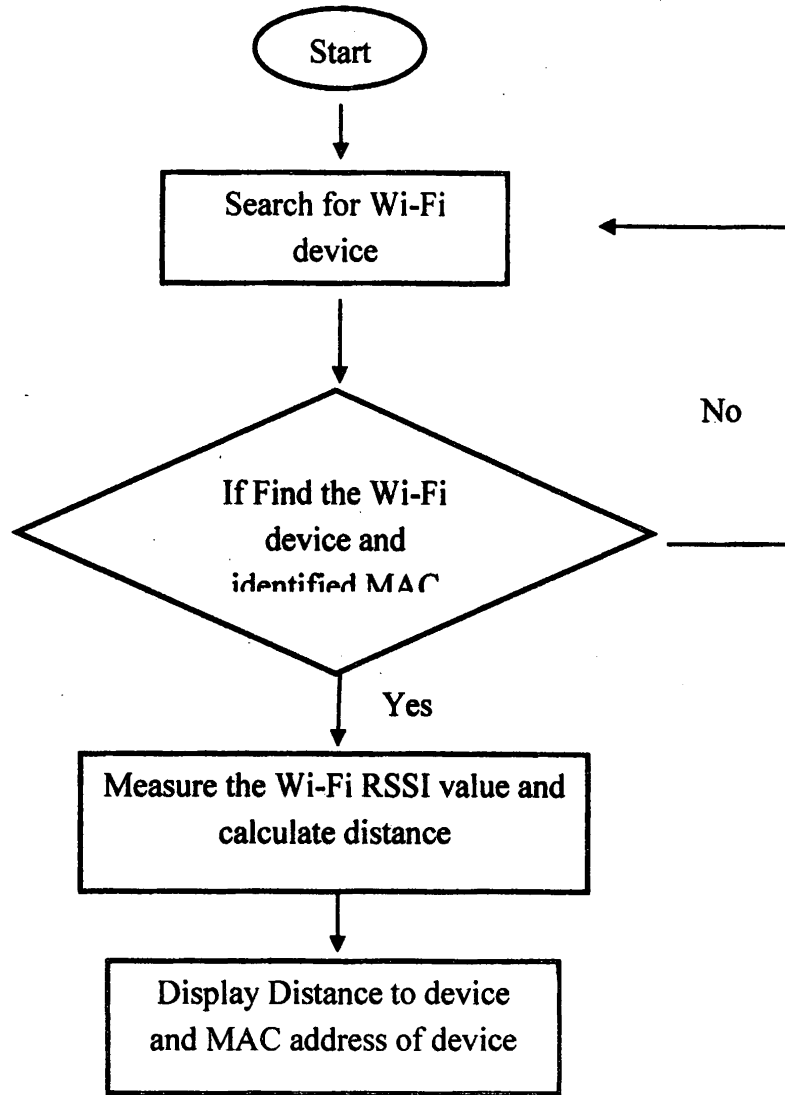


Figure 2: Flow chart for the proposed system

3. RESULTS AND DISCUSSION

From the formulated equation we can measure the distance using Wi-Fi RSSI. This equation is more accurate for open area. Because, data we recorded in open area. Measured data shown in the graph was plotted with the Matlab software. Variation between Wi-Fi RSSI and distance was not linear. Therefore with the use of Wi-Fi RSSI, the measured distance was not much accurate.

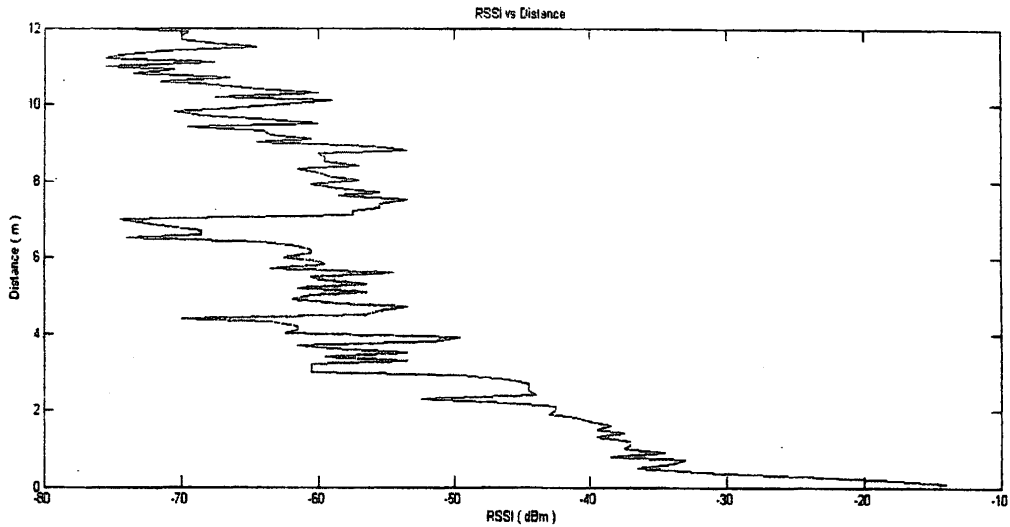


Figure 3 Graph of measured RSSI (dBm) vs. Distance (m)

Using Curve fitting tool in Matlab Software the equation was designed for variation of distance measure through Wi-Fi RSSI.

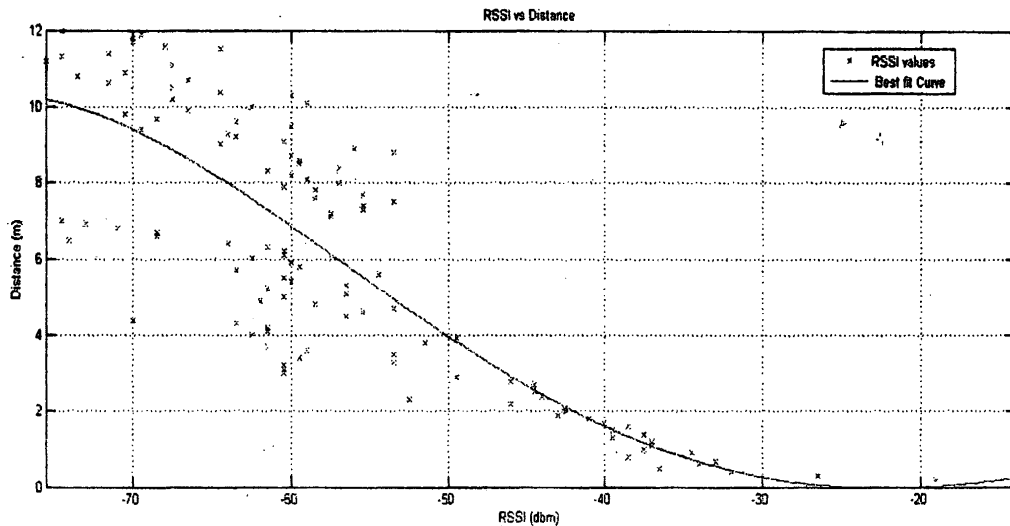


Figure 4 Best fit curve obtained for graph RSSI vs. Distance

The formulated equation is,

$$y = 0.00073 * z^5 - 0.043 * z^4 + 0.3 * z^3 + 0.024 * z^2 - 3.6 * z + 5.9 \quad [1]$$

Where,

$$z = \left(x - \frac{-57}{12}\right), \text{ y is Distance (m) and x is RSSI value (dBm)}$$

From the designed system, Mac address of that device was identified and Wi-Fi RSSI value was measured. Then distance range for that device show will be on LCD.

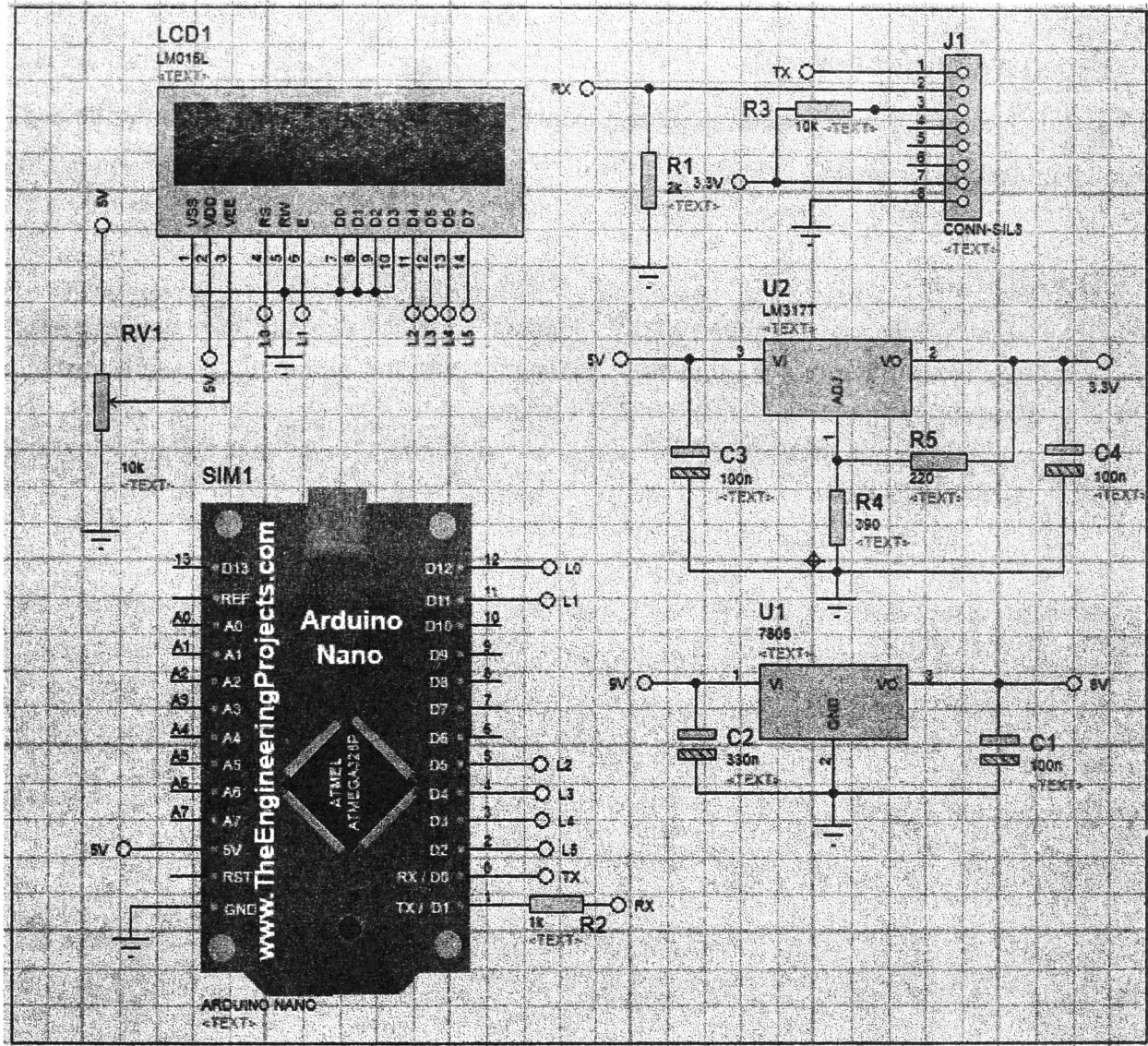


Figure 5 The circuit layout of the proposed system.

4. CONCLUSION

Outdoor positioning mainly uses satellite based technology such as the well-known GPS (Global Positioning System). However, satellite based positioning system need the tracking device to be able to receive line-of-sight signals from satellites, thus it cannot be used within indoors. To overcome this problem, we can use Wi-Fi signal. The purpose of this project was to create a mathematical model to calculate distance between two devices using Wi-Fi received signal strength indication value and then to design simple, low cost but reliable digital system to display distance of device using that mathematical model. This technique is useful for indoor tracking system. As a future work, this can be developed to give location in the indoor using more access points.

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