Behavioural Study of RFID System With Different Types of Sand Particles

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***Abstract*—Today RFID is one of the most advanced Auto-ID Systems available. RFID is one of the most radically emerging technologies. With the recent technological progression at all levels, it is finding its application in various areas and holds a very bright future. RFID definitely still has to evolve into better and robust product but its applications and usage are endless, it gives a window to whole new world of opportunity.**

In this paper we will discuss about the detectability of RFID system under the tropic conditions of arid and semi arid regions i.e. effect of different type of sands, their grain size and sand layer thickness on RFID tag detectability.

Keywords— Detectability , RFID, Tag , Reader.

I. Introduction

Radio Frequency Identification (RFID) is a generic term for non-contacting technologies that use radio waves to automatically identify people or objects. There are several methods of identification, but the most common is to store a unique serial number that identifies a person or object on a microchip that is attached to an antenna. The combined antenna and microchip are called an "RFID transponder" or "RFID tag" and work in combination with an "RFID reader" (sometimes called an "RFID interrogator"). Just like a bar code, a transponder tag carries data about its host. When interrogated by a reader, it responds with that data over a radio frequency link. The transponder could be really simple, like those in clothing price tags, consisting of just an antenna and diode. When irradiated, the diode rectifies the incoming carrier and the frequency-doubled signal is radiated back to the reader which responds with an alarm if you try to leave the store without paying for the product. There are two major types of tag technologies. "Passive tags" are tags that do not contain their own power source or transmitter. When radio waves from the reader reach the chip's antenna, the energy is converted by the antenna into electricity that can power up the microchip in the tag (known as "parasitic power"). The tag is then able to send back any information stored on the tag by reflecting the electromagnetic waves. "Active tags" have their own power source and transmitter. The power source, usually a battery, is used to run the microchip's circuitry and to broadcast a signal to a reader. Due to the fact that passive tags do not have their own transmitter and must reflect their signal to the reader, the reading distance is much shorter than with active tags. However, active tags are typically larger, more expensive, and require occasional service. Frequency refers to the size of the radio waves used to communicate between the RFID system components. Just as you tune your radio to different frequencies in order to hear different radio stations, RFID tags and readers must be tuned to the same frequency in order to communicate effectively. RFID systems typically use one of the following frequency ranges: low frequency (or LF, around 125 kHz), high frequency (or HF, around 13.56 MHz), ultra-high frequency (or UHF, around 868 and 928 MHz), or microwave (around 2.45 and 5.8 GHz).RFID (Radio frequency identification) systems use data strings stored inside RFID tags to uniquely identify people or objects when they are scanned by an RFID reader. These types of systems are found in many applications such as passport protection, animal identification, inventory control systems, secure access control systems, robotics, navigation, inventory tracking, payment systems, and car immobilization. Because passive tags require a strong RF field to operate, their effective range is limited to an area in close proximity to the RFID reader. The distance over which the RFID tag is usable is affected by such things as the tag shape and size, materials being used in the area near the reader, and the orientation of the reader and tag in respect to each other and in their operating environment. The smaller a tag, the closer it must be to the reader to operate. Each transponder tag contains a unique identifier (one of 1,099,511,627,776, possible combinations) that is read by the by the RFID Reader Module and transmitted to the host via a simple serial interface.

II. STUDY AND EVOLUTION

A. Components of set

1) RFID Tag – We have used RFID tags of clamshell card type.This is a basic LF RFID tag used for presence sensing, Aceess Control etc. Works in the 125kHz RF range. These tags come with a unique 32-bit ID and are not re-programmable. Card is blank, smooth, and mildly flexible.

Salient Features:

- carrier 125 KHz
- 2kbps ASK
- 32 bit unique ID
- 64 bit data stream

2) RFID Reader – The reader is RS232 (RFID-1321), RFID reader reads EM4100 family transponder tags that are brought in proximity to the reader and output the unique tag identification number through RS232 serial port @9600 bps. When the RFID Card Reader is active and a valid RFID transponder tag is placed within range of the activated reader, the unique ID will be transmitted as a 12-byte printable ASCII string serially to the host. The reader output 12 byte including one start, stop byte and 10 unique data byte. The start byte and stop byte are used to easily identify that a correct string has been received from the reader (they correspond to a line feed and carriage return characters, respectively). One status LED is provided to indicate card detection. The normal detection range is 10-15CM for Card Type TAGs.

Start Byte	Tag ID	Tag ID	Tag ID	Tag ID	Tag ID
(0x0A)	Digit 1	Digit 2	Digit 3	Digit 4	Digit 5

Tag ID	Tag ID	Tag ID	Tag ID	Tag ID	Stop Byte
Digit 6	Digit 7	Digit 8	Digit 9	Digit 10	(0x0D)

Fig 1.1 Format of 12 byte data

3) Sand – we have used two types of sand i.e. salnadi sand and binawas sand. We have used different types of sand filters, as shown in Fig 1.2, to filter the above mentioned sands in grain size of 1.18 mm, 2 mm and 450 mics.

Fig 1.2 Sand Filters to get three different grain size

4) Digital Vernier Callipers– to measure the read range of the RFID system precisely.

5) Car Jack – for decreasing and increasing the distance between tag and reader for various setups.

B. Procedure

As shown in the Fig 1.3 we kept the reader in stationary position and place the tag in a mounting arrangement attached to the car jack, so tag could be moved upward and downward. We also made sure the whole set up is interfaced with our computer to observe the 12 byte ASCII string received by reader when it detects a tag in its read range.

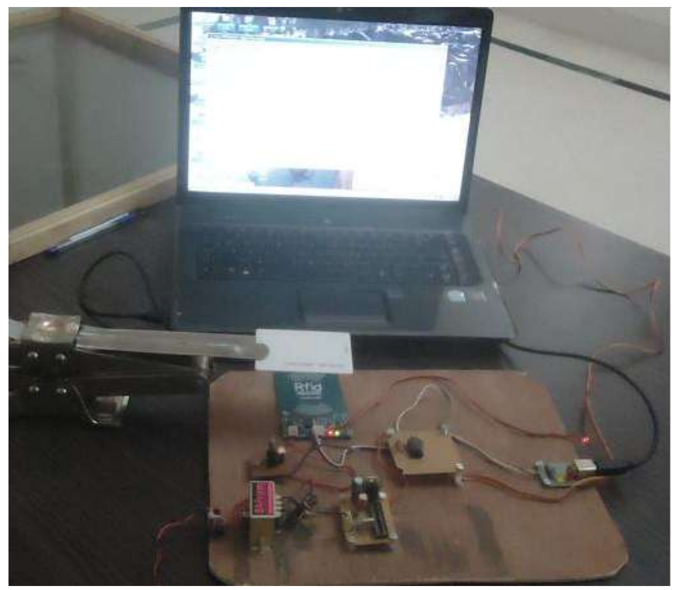

Fig 1.3 Setup for the observation

After that we placed different thickness of sand layer of each sand type and sand grain size over the reader one by one. Then we started moving the tag (attached to car jack) upward form its minimum position till the system stops reading the 12 byte ASCII string. Then with the help of digital vernier calipers we could measure the distance between the reader and the tag i.e. the reading range of system.

C. Measurements

According to the procedure explained above we observed the read range for two different clam shell RFID cards for two types of sand, their three different types of grain size and for different thickness of sand layer between tag and reader. The tag is detected with the help of software interface which displays the respective 12 byte ASCII string of tag it on the computer screen as shown in Fig 1.4.

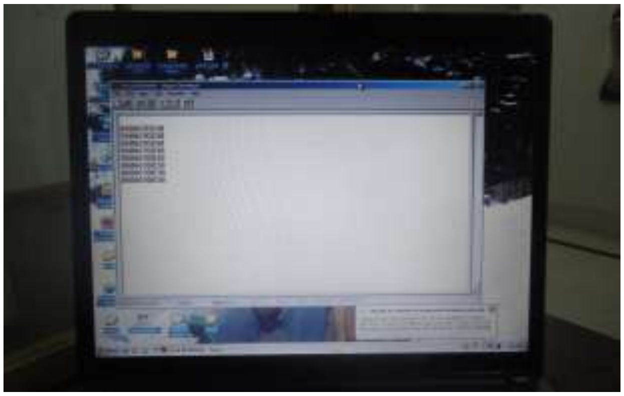

Fig 1.4 Tag detection shown with the help of interface

D. Graphs

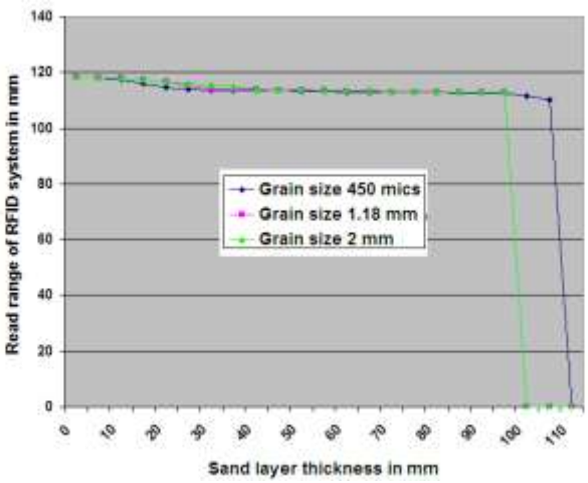

Fig 1.5.1 Binawas sand observation for Tag 1

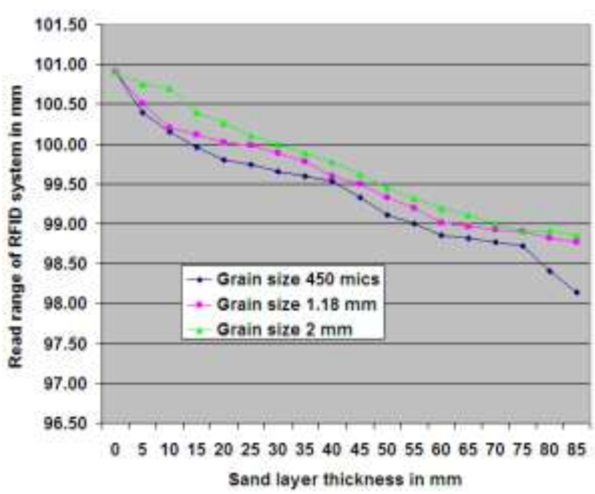

Fig 1.5.2 Enhanced graph of fig 1.5.1

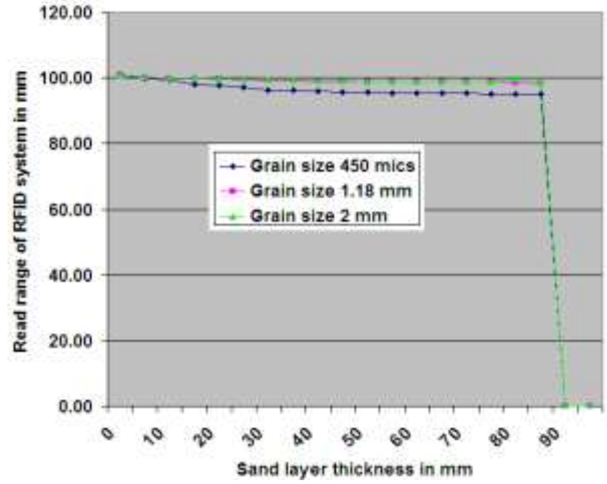

Fig 1.6.1 Binawas sand observation for Tag 2

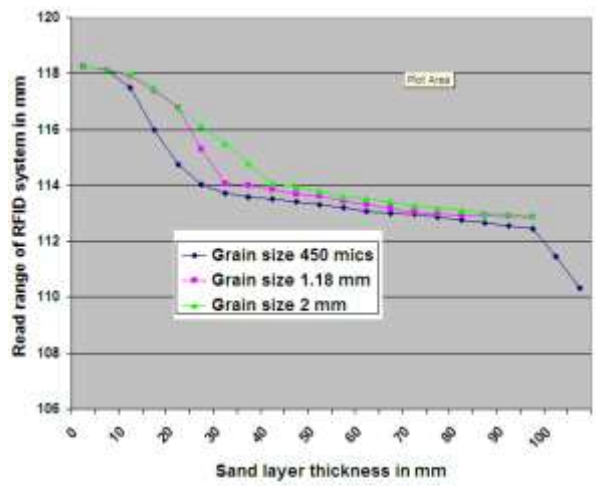

Fig 1.6.2 Enhanced graph of fig 1.6.1

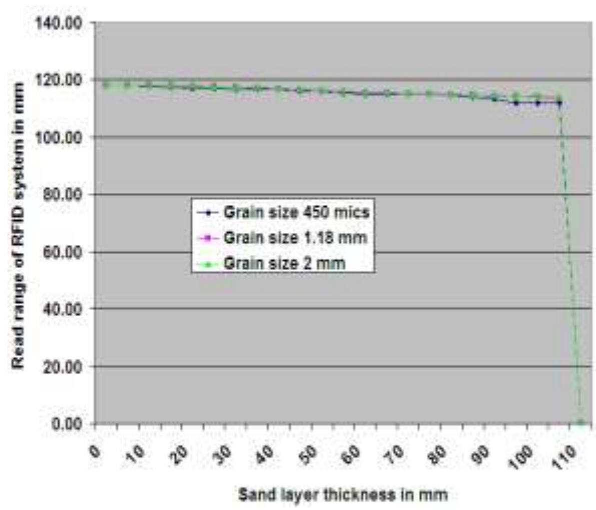

Fig 1.7.1 Salnadi sand observation for Tag 1

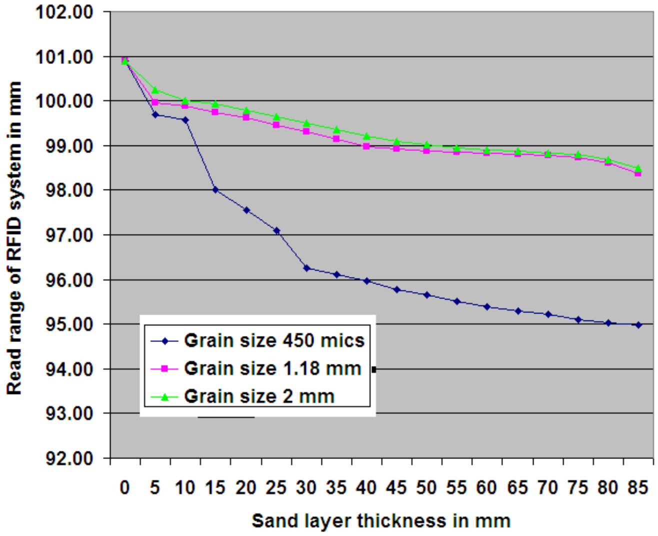

Fig 1.7.2 Enhanced graph for fig 1.7.1

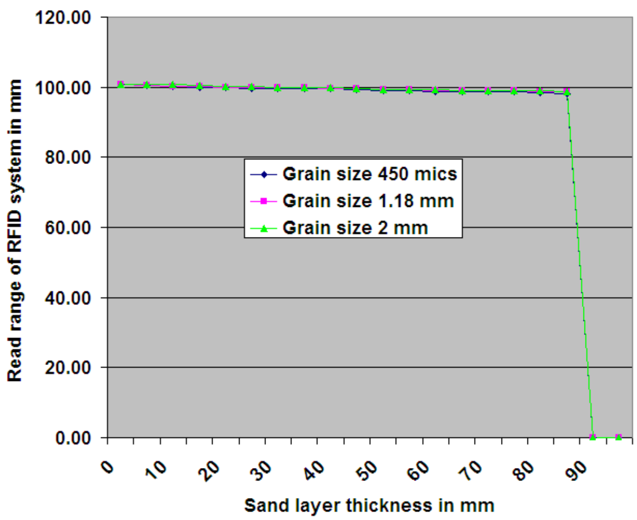

Fig 1.8.1 Salnadi sand observation for Tag 2

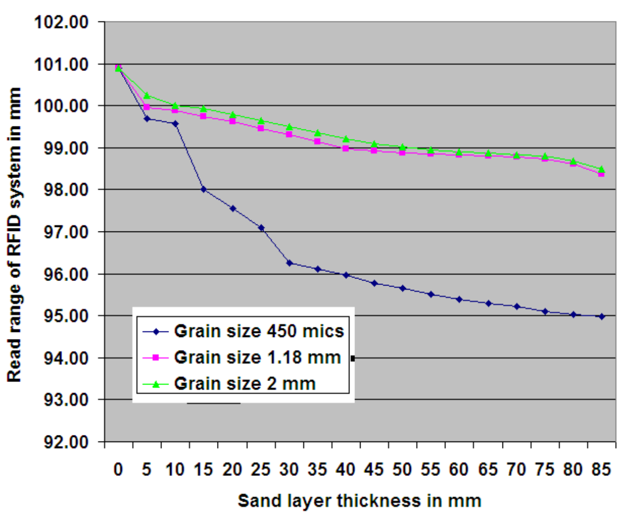

Fig 1.8.2 Enhanced graph of fig 1.8.1

III. CONSLUSION

This paper has compared the detectability of RFID system in presence of different types of sand, there different type of practical size and the thickness of sand layer between the RFID tag and reader and from the above shown graphs we Reached to the following conclusion:

- As the sand thickness increases between the tag and reader, the read range of the system get decreases.
- As the grain size of the sand increases, the read range of the system get increases.

Nevertheless, this selection is inherently limited and many factors that affect this interaction remain to be explored. We hope that the study which we have conducted will be helpful for logistics and for defense purpose in desert area.

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