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# Radio Frequency Identification (RFID) Misplaced Objects

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**Abstract:**

RFID technology is most widely used technology but due to some challenges this technology cannot be market acceptable. Also it is most suitable technology for indoor positioning because other tracing systems such as GPS cannot be used for indoor positioning since it does not get signal from satellites.

In this paper we have implemented a system which detects the objects in home such as keys, mobiles, wallets, medicine box, etc. This system consists of RFID reader, RFID tags and a user interface. RFID tags are attached to the different objects and RFID reader will track object accordingly. Also this system will be helpful in industry and colleges where maintenance of lots of things is required.

The systems which are used currently are inefficient in which cost depends on the rate of data being sent. The aim of this paper is to minimize the errors while detecting the objects and give the improved results compared to other research work.

**Keywords:** RFID, GPS, indoor positioning,

## I. Introduction:

Radio frequency identification (RFID) is a rapidly growing technology that has the potential to make great economic impacts on many industries. While RFID is a relatively old technology, more recent advancements in chip manufacturing technology are making RFID practical for new applications and settings, particularly consumer item level tagging. These advancements have the potential to revolutionize supply-chain management, inventory control, and logistics [1].

It is important for most of the applications that where the objects are placed hence systems which can detect the objects are utilized. Technologies such as RF, application of electromagnetic field strength, etc can be used to detect the objects [1].

The origins of RFID technology lie in the 19th century when luminaries of that era made great scientific advances in electromagnetism. Of particular relevance to RFID is Michael Faraday's discovery of electronic inductance, James Clerk Maxwell's formulation of equations describing electromagnetism, and Heinrich Rudolf Hertz's experiments validating Faraday and Maxwell's predictions. Their discoveries laid the foundation for modern radio communications [2], [5].

The basic theory underlying RFID technology has been understood since the 1930s. Early on it was discovered that the introduction of a conductive material into an electric or magnetic field could alter the field's characteristics. That occurs because the conductive material both absorbs and reflects the energy in the field. If the field is a radio frequency, or RF, the conductive material is capable of imparting a reflection of the source field radiation [2].

Current tracking systems are costly and inefficient where cost is based on rate of data being sent. RFID is the ideal solution for object detection because normal working procedures cannot be changed in future also [3], [4].

## II. Literature Review:

RFID based localization techniques are broadly classified as reader and tag based approaches. In reader based localization techniques, position of RFID tags is determined [5].

In 2003, reference tags are placed and Euclidean distance between the reference tags and target tags are determined. Nearest reference tags are determined are used to determined the position estimate of target tags with maximum localization error of less than 2m [6].

In 2004, laser range scanner is used in combination with RFID reader. This scanner is used to learn the map of reference tag. But this method requires line-of-sight constraints due to which average location error is 1 to 10m. However, this approach imposes line-of-sight constraints, and moreover tag orientation issues degrade the detection probability of the reference tags [7].

In 2005, a method was proposed to localize mobile objects in indoor environment. In their first step, an onboard RFID reader is coarsely localized with respect to neighborhood active reference tags. In the second step, a vision sensor combined with a feature detection algorithm identifies key environmental features to minimize the average localization error to 0.23 meters [8].

In 2006, multiple readers are placed at fixed location and tags at unknown location. A conditional probability model is used where tag detection probabilities vary at different power levels with average localization error of 0.68m. [9].

## III. Proposed System:

There are various methods to detect the object using RF sensors. Some method includes a transmitter attached to the object and location system will give result by gathering information using receiver. In some methods RSSI technique is used to detect the object. Some methods use 'transceiver-free' technique to locate the object

[1]. Out of these methods, this paper focuses on method in which transmitter is attached to object and location is given by whole system. In this proposed system, we tried to minimize the localization error.

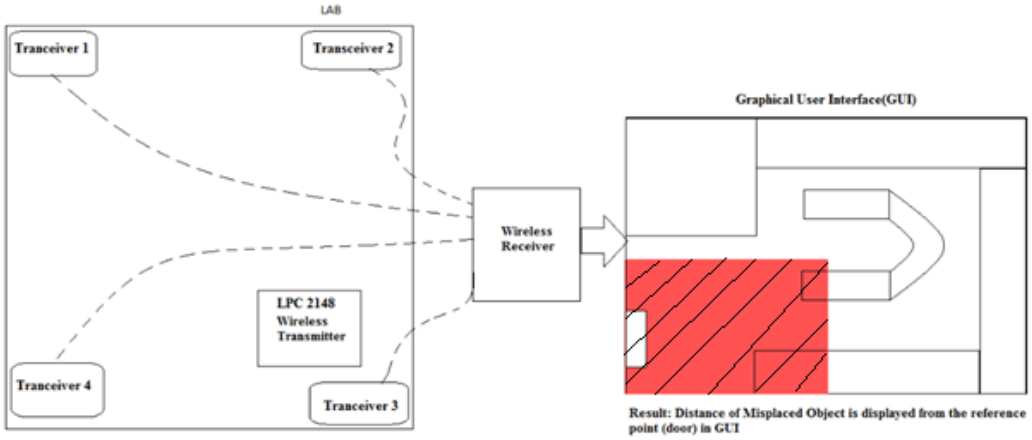


**Fig. 1** Proposed System

Fig. 1 shows the proposed system to locate the object. In this system, four transceivers are placed at 4 corners of one room. These transceivers are interfaced with 89C51RD2. The RF sensors used are CC2500 which are active RFID sensors with battery operated power supply. Hence range of these sensors is greater as compared to passive sensors. Number of sensors can be increased so that search space and time will be reduced accordingly. Wireless transmitter is nothing but a RFID tag which is attached to the object. Transmitter is interfaced with LPC2148.

Each transceiver has a unique reader ID which makes it unique from the others. Wireless transmitter has an object ID which will get transmitted continuously. This transmitted ID is received by any of the transceivers whenever the transmitter is within range of any of the transceivers. After receiving the object ID by the transceiver, this transceiver mix this object ID with its own reader unique ID. This combined ID is then received by wireless receiver which is attached to user interface.

In the fig. 1, Graphical user interface is shown which shows the top view of the room in which transceivers are placed. After receiving the combined ID (Object ID + Reader ID), this combined ID is separated as object ID and Readers ID in the receiver side. After separating, the location of the object is shown in the graphical user interface (GUI). The red or scratched part shown in GUI of fig. 1 indicates that object is present near the door of the room and also approximate distance of object is also shown at the bottom of the GUI.

## IV. Experimental Results:

This section describes how the proposed system works actually. The required result (object location) is shown on GUI. Hence fig 2. Shows how the actual GUI looks like.

The GUI is divided in 4 parts and according to these parts it shows the corresponding location of the object. All the connections are made according to the requirement. As we mentioned in methodology, one room is taken for demonstration and output is seen on GUI.

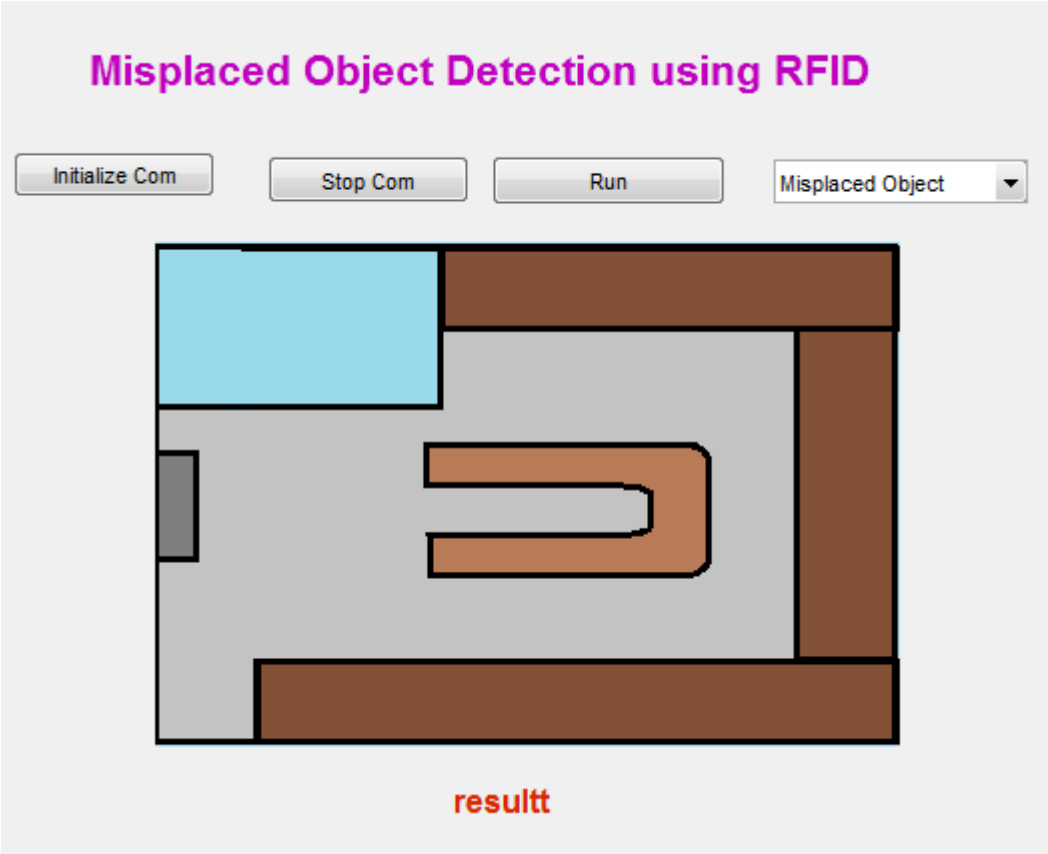


**Fig. 2** Graphical User Interface

After making all the connections, MATLAB code written for working of GUI is opened and made the GUI to work. Now as shown in fig. 2 there are three push buttons present in the GUI (1. Initialize COM 2. Stop COM 3. Run). For the system to give object location, initialize COM button is pressed due to which COM port is opened. After opening of COM port, Run button is pressed so that the system will give result as shown in fig 3.

After showing the location of object, if we want to stop the system then press the 'stop COM' button so that COM port is closed. In this system, all the wireless communication is done by the serial communication using RS 232.

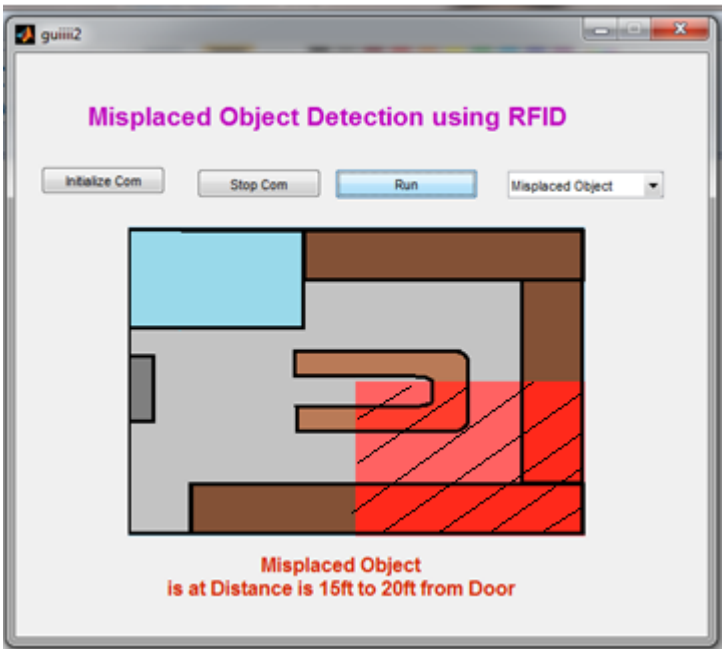


**Fig. 3** Result of propose system (location of object by red/scratched region)

## V. Conclusion:

This proposed system is implemented using serial communication between transmitter and receiver. As mentioned above in methodology and expected results, object location is given due to which search area and search time of user is reduced. In order to reduce search area and time more, number of sensors can be increased so that exact location of the object will be shown. This system is based on wireless sensor network and it also includes embedded system so we can called it as wireless embedded network.

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