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Implementing Anti Collision Algorithm for Multiple Tag Identification

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Abstract— RFID is core technology in the area of ubiquitous computing.To identify the objects begins with the reader query to the tag attached to the subject. When multiple tags exist in the reader's interrogation zone, these tags simultaneously respond to the reader's query, resulting in collision. This kind collision makes the reader to take long time to identify tags within the reader's identification range and impossible to identify even one tag.In RFID system, the reader needa the anti-collision algorithm which can quickly identify all the tags in interrogation zone. This paper proposes a design methodology with two different RF modules, 433.92MHz and 315 MHz are interfaced into microcontroller, encoder, decoder IC's are used.According to query technique, the reader sends the query signal to all tags with one frequency and the tag corresponding to the query will respond to reader with another frequency, likewise anti-collision algorithm is implemented to avoid collision and number of query reponses can be reduced.

Index Terms— Anti collision Algorithom, Active tag, multiple tags, query technique RFID, RF modules, Tag collision.

1 INTRODUCTION

RFID (Radio Frequency Identification) is a technology that deciphers or identifies the tag information through a reader (or interrogator) without contact. RFID have become very popular in many service industries, purchasing and distribution logistics, industry, manufacturing companies and material flow systems. Automatic Identification procedures exist to provide information about people, animals, goods and products in transit [1],[2].

The reader receives required information from the tags by sending and receiving wireless signals with the tag. Since the communication between the readers and the tags shares wireless channels, there exist collisions. The collisions can be divided into the reader collision and the tag collision. The reader collision occurs when multiple readers send request signals to one tag, and the tag receives the wrong request signal due to signal interference between readers. The tag collision occurs when more than two tags simultaneously respond to one reader and the reader cannot identify any tags. This kind of collision makes the reader take long time to identify tags within the reader's identification range and impossible to identify even one tag [3]- [6].

Therefore, the collision is a crucial problem that must be resolved in RFID systems, so many studies to resolve this problem have been carried out as well as are ongoing. This paper focuses on the tag collision problem which occurs in the case where one reader identifies multiple tags. A design methodology is implemented in reader and tag module to avoid collision problem and an anti-collision algorithm is implemented in RFID reader .

2 RFID SYSTEM FOR MULTIPLE TAG IDENTIFICATION

RFID systems typically use small, low-cost, battery free devices called TAGs, which use the radio signal from a specialised RFID reader for power and communication. When queried, each TAG responds with a unique identification number by reflecting energy back to the reader with a technique called backscatter modulation. Usually TAGs are application specific, fixed function devices that have an operating range of 10–50 cm for inductively coupled devices and 3–10 m for UHF TAGs. Traditionally, RFID TAGs have been used as a replacement for barcodes in applications such as supply-chain monitoring, asset management, and building security [8].

When multiple tags are present in readers interrogation area,all tags try to access the reader at a time as a result the reader cannot notify a single tag or take long time for identification as shown in fig[1]

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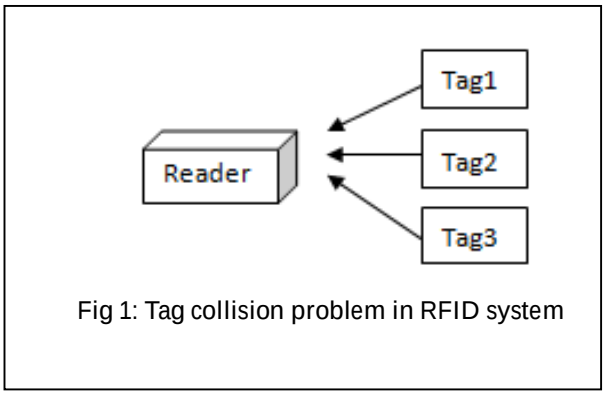

Fig 1: Tag collision problem in RFID system

The tag collision is avoided by implementing an anti-collision algorithm in reader[8][9].In RFID an anticollision algorithm is implemented suchthat The Reader continuously queries the tags one by one for the identifications. Whenever the tag is identified then the data will be processed through RF signals from tag to reader. In the reader module the data is decoded and stored in EEPROM of the controller. The controller sends the data to PCfor display purpose as shown in fig [2]. In this way multiple tags can be identified by reader query and data can be retrieved.

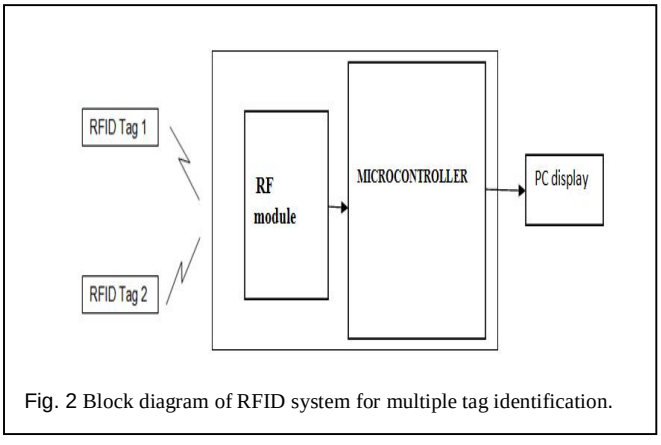

Fig. 2 Block diagram of RFID system for multiple tag identification.

The hardware modules are divided into these categories

- RFID tag module
- RFID Reader module

2.1 Active RFID Tag Module

Active tags are powered by an internal battery and are typically read / write. The life of an active tag is limited by the life of the battery. The data within an active tag can be rewritten or modified. An active tag's memory can vary from a few bytes to 1MB. The battery-supplied power of an active tag generally gives it a longer read range. The trade off is, greater the size the greater cost, and a limited operational life. Depending upon the battery type and temperatures, the life of such tags could be 10 years. Some active tags can also be smart and do not send their information all the time. In a typical read / write RFID system, a tag might give a machine a set of instructions, and the machine would then report its performance to the tag. This encoded data would then become part of the tagged part's history. This data can be detailed about the port of transit with dates.

The RFID transponder is sometimes called the RFID tag or an inlay. The transponder is usually made of an antenna that is bonded to an integrated circuit (IC) chip. The IC chip contains the RF circuit, encoders, decoders, and memory as shown in fig [3].

Active transponders are woken up when they receive a signal from a reader. Active tags have a read range of up to 300 feet (100 meters) and can be read reliably because they broadcast a signal to the reader . This active RFID tag module consists of a transmitter with a encoder and receiver with decoder to interpret the data, and microcontroller programmed with information. The RF provides a means of communicating with the interrogator. Active tag consists of transmitter, receiver and for data security encoder and decoder modules are used. Whenever the query from the reader comes to tag then the query will stored in the receiver buffer and then it is processed to microcontroller and the relative data operations will be done. Then the ancknowledgement signal is transmitted to reader via transmitter

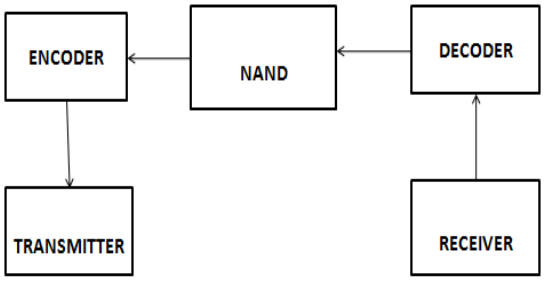

Fig.2. Block diagram of Active RFID tag.

2.2 RFID Reader Module

RFID technology explaining how an RFID chip interacts with a reader through different radio wave frequencies. A Reader is also called interrogator, is comprised of a transmitter, receiver, control module and PC connection for data display [6]. The query response is sent through the RF-transmitter to tag RF-receiver for tag identification .once the tag is identified, the tag sends encoded data through RF-transmitter. The reader receives data through RF-receiver and data is decoded and checks whether queried tag is identified or not. Data is displayed on PC dis-

play through serial communication interface.The RFID reader modulu shown in the fig [4]

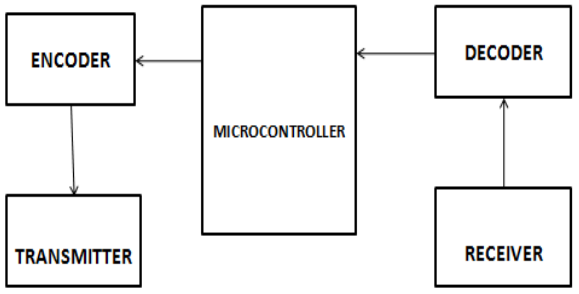

Fig.4. Block diagram for RFID reader module.

3 SOFTWARE IMPLEMENTATION

Tag collision in RFID systems happens when multiple tags reflect the signal back to the reader. This problem is often seen whenever a large volume of tags must be read together in the same RF field. The reader is unable to differentiate these signals from all; tag collision confuses the reader.

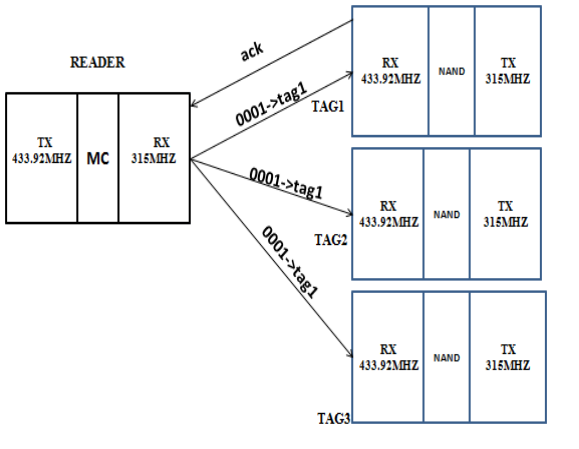

Fig.4. Showing the functionality of RFID system

To avoid the collision two different frequencies of RF module are interfaced with microcontroller. With one frequency (433.92MHz RF TX) module the reader sends query to all tags. All tags receive signal with 315MHz RF-Rx module and check for match of data and address of the received signal .Then Corresponding tag transimitter module is enable and sends the acknowledgement signal with another frequency,suchthat the remaining tags don't receive the acknowledgement signal of corresponding query tag. In this way the reader sends simultaneous queries to tags and acknowledgement is retrieved from each tag separately as per query as shown in fig [5].

3.1 Algorithm for Multiple Tag Identification

Step1: Reader initialization
Step2: Sends the query to all the active tags
Step3: Decoder of each tag checks for corresponding query
Step4: If match occurs then (valid transmission) VT=1
Step5: If VT=1 then (transmission enable) TE=0 for transmitter to send acknowledgement
Step6: Then VT bit of reader will be active high and data will be sent
Step7: Goto step2

3.2 FLOW CHART OF RFID SYSTEM

The reader sends query signal to all the tags. For example if 0001 is the data related to the tag1 ,the data is encoded and send to all the tags present in the readers interrogation area. All tags will decode the data and checks whether the data and address are correct or not. If match occurs then VT (valid transmission) of the corresponding tag will be high which makes the TE (transmission enable) low of the encoder for sending acknowledgement signal to reader. once the acknowledgement signal is received then it send data serially to PC for display purpose and again start querying for next tag and continue the process until all tags are identified as flowchart shown in fig[6].

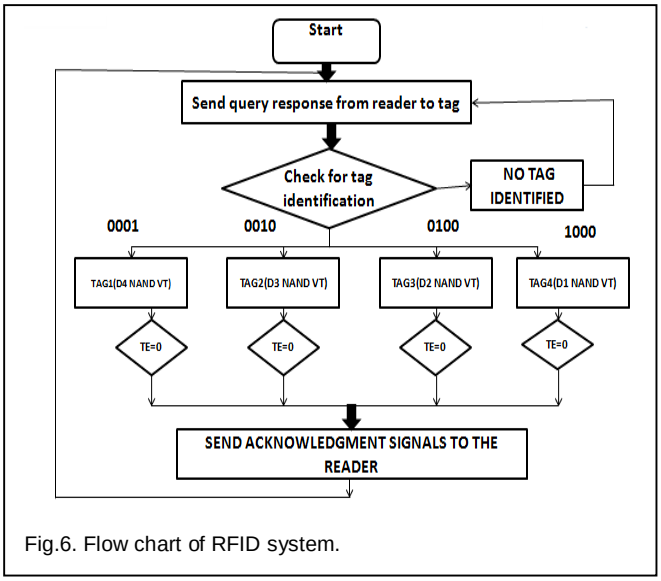

Fig.6. Flow chart of RFID system.

4 HARDWARE IMPLEMENTATION RFID SYSTEM

4.1 RFID Tag Module

The tag module as shown in fig [7] consist of RF transmitter (433.92MHz) and receiver module (315MHz), data security encoder and decoder modules. Tag receives

query signal from the reader through RF receiver and data is decoded by HT12D decoder. Then the corresponding tag VT (transmission) will be high in decoder, which makes the RF transmitter enable (TE=0) . Tag sends the acknowledgement signal to the reader module through RF transmitter.

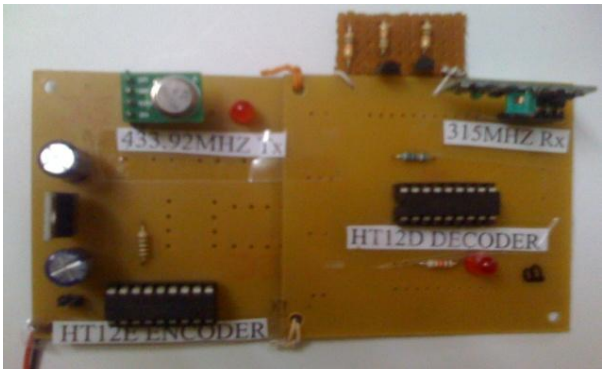

Fig. 7. RFID Tag module.

4.2 RFID READER MODULE

The reader module as shown in fig[8] consist of microcontroller,RF transmitter (315MHz),RF receiver (433.92MHz) , HT12E encoder and HT12D decoder IC's and serial port for PC serial data transfer. Once the reader is power up, then microcontroller starts querying each tag one by one. The encoded data is sent to all tags through RF transmitter [10] and corresponding tag will sent acknowledgement signal to the reader and data is sent through serial port from controller to the PC for display purpose.

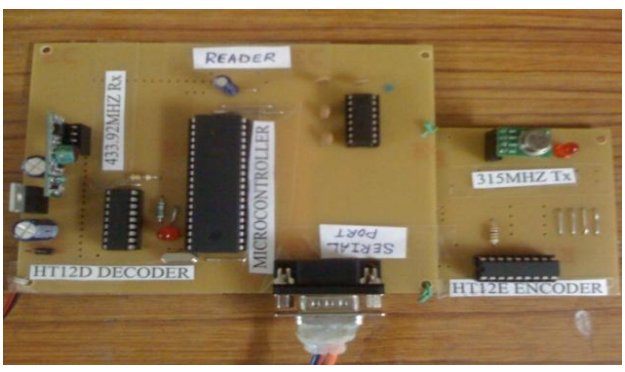

Fig.8. RFID Reader module.

4.2 PROPOSED RFID SYSTEM

The RFID reader is connected to laptop through USB to serialport converter as shown in fig [9].Hyperterminal window is launched in PC by configuring with serial port and setting the properties of port. All the tags are made active by powerup in interrogation area .once the reader is powerup then the microcontroller start sending query signals to all the tags and identified tag data is displayed on the screen.

Fig.9. proposed RFID system.

5 RESULTS AND DISCUSSIONS

When the reader is active, then microcontroller runs and in hyper terminal it asks to press any key to scan as show in fig [10]. If any key on keyboard is pressed then it start scaning all tags which are present in reader's interrogation area and identified tags are displayed on screen.

If tags are not present in the reader's interrogation area then it again ask to press any key to start scanning for tags.It is as shown in fig [11].

The tags which are active in reader's interrogation area are identified and displayed on the screen as shown in the following figs [12][13][14].

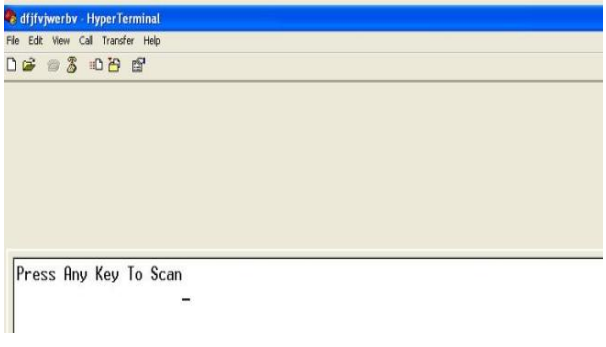

Fig.10. Reader initialization

Fig.11. No tag is identified

Fig.12. Two tags are present in reader's interrogation area

Fig.13. Three tags are present in reader's interrogation area,

Fig.14. Four tags are present in readers interrogation area.

7 Conclusion

In RFID system, the tag collision problem occurs in multitag environment where multiple tags have to be identified. The anticollision algorithm is necessary to arbitrate the collision and to identify all the tags faster.

When multiple tags exist in the reader's interrogation zone, these tags simultaneously respond to the reader's query, resulting in collision. To avoid the collision two different frequencies of RF module are interfaced with microcontroller. With RF transmitter module the reader sends query to all tags in interrogation area. Once the corresponding tag is identified, the tag transfers data with another frequency, so that only required tag can be identified. In this way the reader sends simultaneous queries to tags and data is retrieved from each tag. By using this design methodology multiple tags can be identified in efficient mannerand number of query responses from reader are reduced.

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