JEWELLERY THEFT PREVENTION SYSTEM

Submitted by:

DEVARCHANA DEV CHOUDHURY SANGBORTIKA DAS SHARAD BHOWMICK

ABSTRACT:

This project proposes a new way of protecting jewellery from theft by using Radio Frequency Identification (RFID) system. In general, RFID system has 3 parts- Antenna, Transceiver (or reader) and Transponder (or tag). In this particular system, passive tags of distance type are going to be used. The transceiver will be programmed using an Arduino, such that it gives out a signal when the transponder goes out of its pre-set range. The transceiver will be attached with a LCD screen and a buzzer, which will enable the system to sound an alarm and display a message every time the transponder goes out of range.

This system can be easily installed at home or even carried around.

For future aspect it has been planned to incorporate the the current project with internet of things (IOT) to track the stolen goods by the security personnel by using the already installed RFID recievers in public places.

INTRODUCTION:

A general RFID system consists of 3 parts-

Antenna
Transceiver (or reader)
Transponder (or tag)

In this particular system, passive tags are going to be used. Passive tags harvest energy from electromagnetic field created by the reader. The reader feeds the antenna or coil (attached to reader) an oscillating signal- that field couples to the tag's antenna or coil. The signal is rectified and charges a small capacitor which powers the tag.

ANTENNA

A critical part of designing the reader is creating an antenna which will most efficiently carry a signal to/from the tag. While commercial antennas can be used, they are expensive. It is common to build one using PCB tracks to form a loop.

Maximum energy transfer occurs when the antenna and associated components are in resonance. That happens when the reactance of the inductor is equal to that of the capacitances.
Capacitive reactance is:

$$X_c = \frac{1}{2\pi f C}$$

where, f is the frequency (125 KHz or 13.56 MHz) and C is in Farads.
Inductive reactance is just the opposite:

$$X_L = 2\pi f L$$

Here, L is in Henry

Measure the inductance of the antenna with an LCR meter. Setting the two equations equal (since the reactances are the same at resonance) and solving for C:

$$C = \frac{1}{(2\pi f)^2 L}$$

C is the total capacitance of the antenna system.

TRANSCEIVER

All modern RFID reader ICs take care of the entire RF front-end and handle all of the modulation and message passing. The IC's interface is entirely digital using a conventional parallel or serial bus.

The part includes signal strength measurements as well as a programmable power level to the RF front-end. An application can use these features to communicate at low power to maximize battery life in portable applications, but it can dynamically boost the RF levels if the tag's signal is weak.

Like many of these devices, it will automatically detect a short-circuited or open antenna. It is checked every cycle of a transmission; it is up to the code in the processor that is controlling it to shut down transmission to keep the device from failing. Idle and power-down modes can drop quiescent current to under 20 µA.

TRANSPONDER

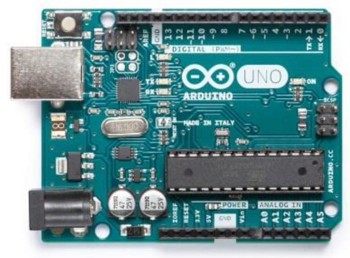
Tags are most often used as simple data storage devices. The reader extracts a tag's unique ID to track packages and the like. Or it could write information.

The critical specification for any tag is the memory size. Read-only devices typically can store a 64- or 80-bit unique number that is written by the factory. Read/write versions will have anywhere from 256 bits of user-memory up to tens of thousands of bytes.

Read/write transponders will always have a command set used to control store and read data. Generally, the command set is very simple: read, write, and announce your ID. Some include a kill, which causes the tag to go inactive forever as a security precaution.

Tags are usually dead – totally unpowered and not in any sort of sleep mode unless interacting with a reader. When the reader initiates a data exchange it first drives the antenna for, typically, 15 to 50 msec. That excites the resonant circuit on the tag and charges the capacitor.

Arduino Uno



Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol

LITERATURE SURVEY:

RFID for Personal Asset Tracking-Report

The proposed mobile device uses Radio Frequency Identification (RFID) to keep track of registered objects that are within range of the user. The goal is to provide a new security solution for keeping belongings that are carried around. The device consists of a mobile RFID reader and a control program with a graphical user interface. The assets are attached with RFID tags with unique identifiers for each tag by using EPC Gen2. The graphic interface allows the user to create a catalog of objects that are to be kept track of. Personal items such as keys, wallets, passports, jewelry, watches, glasses, medicine, portable flash drives, electronic devices (cell phone, PDAs, laptops, mp3 players, calculators) can be tracked using this system.

Security Applications Challenges of RFID Technology and possible countermeasures-Report

Radio Frequency Identification (RFID) is a technique for speedy and proficient identification system, it has been around for more than 50 years and was initially developed for improving warfare machinery. RFID technology bridges two technologies in the area of Information and Communication Technologies (ICT), namely Product Code (PC) technology and Wireless technology. This broad-based rapidly expanding technology impacts business, environment and society. The operating principle of an RFID system is as follows. The reader starts a communication process by radiating an electromagnetic wave. This wave will be intercepted by the antenna of the RFID tag, placed on the item to be identified. An induced current will be created at the tag and will activate the integrated circuit, enabling it to send back a wave to the reader. The reader redirects information to the host where it will be processed. In an RFID system, reproduction of tags is quiet easy. Culprits needs to read the tag and to write the identifier on a different tag. Affixing a password could improves security but it does not makes the system fully secure since techniques of researching passwords are very developed.

Complete RFID Security Solution for Inventory Management Systems

Radio Frequency Identification (RFID) technology is becoming prevalent across the globe due to the low cost of each tag and high convenience it offers in tagging objects individually. These RFID tags respond to queries from all readers and thus compromises the privacy and security of the personal information stored on the tags as these tags can be read by anyone without consent. If the security aspect can be taken care of then the prevalence of RFID technology will increase many folds especially in the commercial sector for tagging goods. In this paper, we propose a complete RFID security solution for inventories and warehouses.

Radio-frequency identification(RFID) is a technology which uses electromagnetic waves to achieve communication between a tag which stores the information required for automatic identification and a reader which requests or writes information into the tags.

Review on RFID Identity Authentication Protocols Based on Hash Function

Radio frequency identification (RFID) is one of the key technologies of Internet of Things, which have many security issues in an open environment. In order to solve the communication problem between RFID tags and readers, security protocols has been improved constantly as the first choice. But the form of attack is also changing constantly with the development of technology. In this paper we classify the security protocols and introduce some problems in the recent security protocols. Radio Frequency Identification (RFID) is a non-contact automatic identification technology, it uses Radio Frequency signal to complete the automatic identification to obtain relevant information of target acquisition, at the same time complete the exchange of information among the target objects, having a wide range of applications among Internet of things. RFID is widely used in the fields of access control, logistics, monitoring, tracking, anti-counterfeiting, identification, security, military, and medical treatment because of its non-contact, fast identification of moving objects, high identification efficiency, can work in harsh environment and convenient operation and so on, But at the same time caused a lot of security issues.

A Study of Key Technologies for IoT and associated Security Challenges

There are many hitches regarding security matters for Internet of Things (IoT), which need to be solved yet, including RFID tag security, cyber security wireless security, network transmission security and privacy protection etc. This article basically explores the existing studies on IoT security issues and the mixture of two main technologies of IoT in context of their threats, corresponding security requirements and their solutions while moving toward synthesizing a model for the security and data piracy issues from various viewpoints. This generic model for implementing security comprises of, combination of security standards and corresponding security requirements heading on the functional architecture of IoT.

IoT is the most rapidly increasing technology spreading all over the world but there are some security concerns regarding its expansion. Security, Privacy and trust must not be neglected by the independent communication of the objects. There are definite network security issues in IoT technologies by the growing trend. The hackers can easily attack the IoT system which can be a great risk for the end user in daily life. By fulfilling various security requirements, it will not be cumbersome to embed security in the remote devices.

FUTURE DIRECTION:

This project can be further developed by designing an app which can be linked to the RFID reader, such that it notifies the user every time the tag which is attached to the jewellery goes out of range.

The app can be installed on all mobile devices, laptops and tablets, which will enable the users to receive notifications even when they aren't around the RFID system.

The Internet Of Things is a rapidly growing industry which can be clubbed with the proposed idea in order to create a more secure and foolproof method of theft detection.

RFID's are used all over the cities such as for taking attendance in institutions or to check the amount of goods left in the inventory, it has been widely used for public transportation system which detects the start of journey and end of journey to automatically detect the transit time and distance hence all these systems works in real time data monitoring.

So, the lost article can be put up in a centralalised lost section using the app and hence the lost article can be easily tracked by the concerned person or security personals.

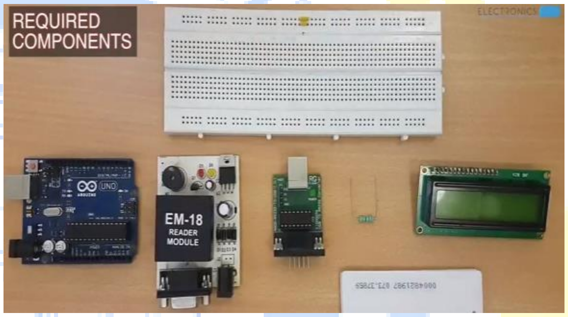
PROPOSED METHODOLOGY:

RFID 9640 tag will be used for this application. The tag will be attached at the back of the jewellery. Arduino board along with the LCD screen and the buzzer will be mounted on a bread board and connected. With the help of an USB to Serial Converter, the RFID reader will be connected to this arrangement.

For power source, this project uses a battery pack (5V or 12V) instead of the conventional wire-based charging system. The batteries are of disposable type and after they run out they can be easily replaced.

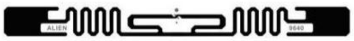
With the help of Arduino board the reader will be programmed to emit a signal when the tag goes out of preset range. The buzzer connected to the system sounds an alarm and the LCD screen displays a message stating that the particular tag is out of range.

Operating Frequency Range:865-867 MHz
Power Supply: 5 V or 12 V



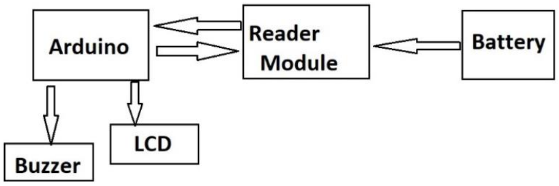
GENERAL RFID READER COMPONENTS

RFID chip embedded in jewellery

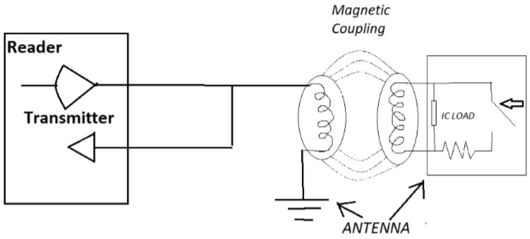


RFID 9460 tag

BLOCK DIAGRAM:



RFID Working



DISCUSSION:

- The idea of the project is to create a tracking and protection system which is cheaper then the traditionally available systems.
- This project is concerned with giving a motility turn to the conventional RFID tags available in the jewellery shops.
- Here by it is more consumer friendly and even the general class can avail to the facility.
- It can be used on the go just by attaching to the jewellery. It is externally attachable and need not be permanently embedded.
- In general, the reader is charged from a laptop or for that matter any such bulky charge storage device. But this project portable batteries for the same which makes it handy as well as portable.
- The protecting system will be programmed such that it detects when the tag along with the jewellery is taken out of range of the reader, unlike the RFID tags available in the jewellery shops which detect under the increase in vicinity of the reader and the tag.

SUMMARY:

- Jewelleries can be protected and detected on the go.
- It can detect till a radius of few feet.
- As well as result can be known.
- One doesn’t have to store the jewellery but can also use it while wearing the jewellery.
- The proposed method can be implemented for all the articles irrespective of size and shape

APPENDIX:

Arduino code.

```
#include<SoftwareSerial.h>
SoftwareSerial mySerial(9,10);
int read_count=0;
int j=0,k=0; // Variables to iterate in for loops
char data_temp, RFID_data[12];
char Saved_Tags[1][12]=
{'4','F','0','0','4','6','F','A','5','B','A','8'};
                boolean tag_check,tag_status,entry_control;
void setup()
{
mySerial.begin(9600);
Serial.begin(9600);
pinMode(8, OUTPUT);//SEN 1
digitalWrite(8, LOW);
}
void loop()
{
RecieveData();
CheckData();
AccessCheck();
}
void RecieveData()
{
if(mySerial.available()>0)
{
data_temp=mySerial.read();
RFID_data[read_count]=data_temp;
read_count++;
}}
void CheckData()
{
if(read_count==12)
{
entry_control=true;
for(k=0;k<3;k++)
{
for(j=0;j<12;j++)
{
  if(Saved_Tags[k][j]==RFID_data[j])
 {
  tag_check=true;
  }
  else
  {
  tag_check=false;
  break;
  }
}
if(tag_check==true)
{
tag_status=true;
}}
read_count=0;
}}
void AccessCheck()
{
if(entry_control==true)
{
if(tag_status==true)
{
Serial.println("Access Granted");
digitalWrite(8, HIGH);
}
else
{
Serial.println("Access Denied");
}
entry_control=false;
tag_status=false;
}}
```