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RFID and GSM Based Advanced Postal Data Communication

P.Siva Nagendra Reddy[1], K.Tharun Kumar Reddy[2], R.Naresh Naik[3]

Assistant Professor, Dept. of ECE., Kuppam Engineering College, JNTUA, Kuppam, Chittoor, A.P, India[1]

P.G.Scholor, Vemu Institute of Technology, P. Kothakota, Near Pakala, Chittoor, A.P, India[2]

M.Tech (VLSI System Design), Dept. of ECE, Vemu Institute of Technology, P. Kothakota, Near Pakala, Chittoor, A.P, India[3]

ABSTRACT: Radio Frequency Identification (RFID) refers to an Auto-Identification system comprised of RFID tags, readers and the requisite middleware that interprets tag information and communicates it to the application software. RFID tags contain specific object information in their memory, accessed via the radio signal of an RFID reader[1] .On the surface, this appears to be similar to how a barcode infrastructure works: the barcode label contains the relevant product information that is read by a barcode reader, and then communicated to the application software. However, there are significant differences with RFID from an operational perspective that gives businesses the opportunity to redefine their logistical processes. Many have referred to this technology as a replacement for barcodes; this is simplistic as it has advanced capabilities that cannot be duplicated with barcodes. Unlike the barcode where identification is limited by line-of-sight, RFID technology and its reliance on radio waves does not require a line-of-sight for identification or a straight-line alignment between the tags and readers. As is common with emerging technologies, several challenges must be overcome for the technology to mature to its full potential. In the case of RFID, these challenges include: maturation of technology, harmonization of standards for hardware/software and wireless spectrum operations, privacy and security concerns, and implementation cost barriers. As these technical and policy challenges are mitigated, RFID will likely become the system of choice for global commerce. The Secured Postal Data Communication is based on RFID technology – One of the best proved wireless technologies. The main concept of this is to keep track of the courier from the dispatch place until it reaches the designated person using GSM modem. The usual practice of sticking the stamps on the each postal cover will be replaced by passive RFID tags. Each RFID tag will be having unique 10 digit number and that number will be provided to the person who posts the cover, so that the person can have the track of the postal cover. The authorized person at the postal department will be entering another 10 digit number, inscribed on the designated receiver RFID tag.

KEYWORDS: RFID, GSM

I. INTRODUCTION

RFID is a very promising technology with significant impact. Following are the reasons for us to use this technology for students' administration application.

- No line of sight required.
- Tags can be read from significant distances.
- Multiple tags can be read at the same time.
- Because tags must be enclosed, they are much more difficult to tamper.
- Many tags are read / write capable, rather than read only.

A fundamental component in this transformation has been radio frequency identification (RFID) a 'next generation' technology that has long been touted by suppliers as a miracle cure for improved efficiencies of secured postal data communication using RFID within the supply chain. Radio Frequency Identification RFID is the reading of information on small devices using radio frequencies or thereabouts. It largely avoids the problems of human error and cost, of miss orientation, obscuration and needing to read many at a time that plague barcodes, phosphor dots, print and other alternatives in the postal and courier service. It is an enabling technology of incredibly broad applicability. That is why

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RFID is already used in the postal and courier service for secure access by people to vehicles and secure areas, secure access of vehicles to yards, location of parcels, conveyances, trailers and much more besides. RFID monitors the performance of the letter post, matches letters to postal boxes to prevent errors and records when and how much a sensitive package has been overheated in transit."RFID technology has massive potential for the postal sector because it's primarily used to track items that are constantly on the move". The concept of RFID technology is relatively simple. To start with, a special tag is placed on each item that requires tracking, for example a small parcel that is travelling from Doha to Dubai. The tags are more versatile than barcodes and have been designed to carry a greater amount of information. Moreover, barcodes are read-only, whereas the data on RFID tags can be updated at different stages of the journey.

RFID TAGS:

RFID tags come in three general varieties:- passive, active, or semi-passive (also known as battery-assisted or semi-active) and beacon types. Passive tags require no internal power source, thus being pure passive devices (they are only active when a reader is nearby to power them by wireless illumination), whereas semi-passive and active tags require a power source, usually a small battery. Beacon tags transmit autonomously with a certain blink pattern and do not respond to interrogation.

Passive RFID tags:

Passive RFID tags have no internal power supply. The minute electrical current induced in the antenna by the incoming radio frequency signal provides just enough power for the CMOS integrated circuit in the tag to power up and transmit a response. Most passive tags signal by backscattering the carrier wave from the reader. This means that the antenna has to be designed both to collect power from the incoming signal and also to transmit the outbound backscatter signal. The response of a passive RFID tag is not necessarily just an ID number; the tag chip can contain non-volatile data, possibly writable EEPROM for storing data.

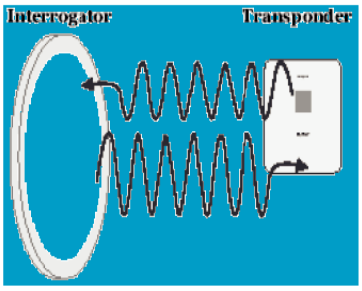

Fig 1: Passive RFID

Active RFID tags:

Unlike passive RFID tags, active RFID tags have their own internal power source, which is used to power the integrated circuits and to broadcast the response signal to the reader. Communications from active tags to readers is typically much more reliable (i.e. fewer errors) than those from passive tags due to the ability for active tags to conduct a "session" with a reader.

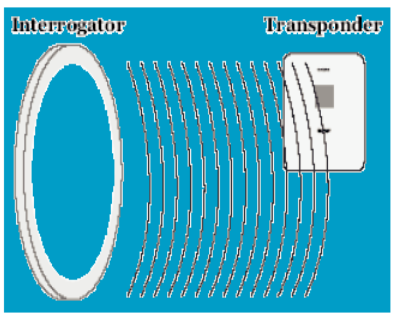

Fig 2: Active RFID

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Beacon tags:
Beacon tags blink the coded identity signal at a regular pattern. This may be a constant blink rate or a blink rate with stochastic shift or some triggered blinking. Not to activate the responder function in a tag first prevents from limiting the speed capabilities and improves the availability of the identification information under noisy conditions. Therefore the beacon concept appliers to very robust processes: The regular availability of the coded signal reduces latency and allows for low power levels, as with active tags. However, the permanent talk of many tags may pollute the frequency channel and therefore prevent from operating in denser populations. The design of the blinking scheme must take the battery life cycle into account. Currently (2008) none of the offered products follows any known line of international standardization. However, all blinking must obey the national wireless communications regulations concerning power level and channel occupation.

II. RELATED WORK

A handheld or fixed reader then scans the tags using radio frequency waves to exchange data, such as dates or destination, and instead of one-by-one scanning, the technology has the ability to read hundreds of items at the same time, regardless of whether the tag is actually visible. Despite the obvious benefits, not to mention the hype that has generated over the years, RFID has failed to create the impact that many suppliers had predicted, "We are tracing actual mail items and gathering information only for the purposes of speeding up and improving delivery. The information will give us further network transparency and consequently our clients will feel more confident about their mail being secured, protected and delivered to the right place at the right time."Applications most often have differing requirements in their use of RF technology, with RFID tag and contactless smart card technologies providing very different capabilities. RFID is emerging as a complementary technology to help overcome some of the drawbacks associated with bar code technology. Barcodes have one significant downfall- they require line-of-sight technology. That means the scanner has to see the barcode to read it, which usually means items have to be manually oriented toward the scanner for it to be read. Conversely, RFID does not require line-of-sight and can be read as long as the item is within range of the reader. RFID tags are simple, low-cost and disposable and are being used to identify animals, track goods logistically and replace printed bar codes at retailers. RFID tags include a chip that typically stores a static number (an ID) and an antenna that enables the chip to transmit the stored number to a reader via electromagnetic waves. When the tag comes within range of the appropriate RF reader, the tag is powered by the reader's RF field and transmits its ID to the reader. RFID middleware provides the interface for communication between the interrogator and existing company databases and information management systems. One of the biggest objections to RFID is the lack of security. There is little to no security on the RFID tag or during communication with the reader. Any reader using the appropriate RF signal can get the RFID tag to communicate its contents. Typical RFID tags can be easily read from distances of several inches (centimetres) to several yards (meters) to allow easy tracking of goods. RFID tags have common characteristics, including: low cost, high volume manufacturing to minimize investment required in implementation and minimal security, with tags able to be read by any compatible reader. In addition, disposable or one-time use, minimal data storage comparable to bar code, usually a fixed format written once when the tag is manufactured and finally, read range optimized to increase speed and utility. There are many areas that benefit from the use of RFID. The technology can be used in Document Tracking Applications as a way to improve the management of important document files in industries like insurance and legal where the loss of such files can cause severe problems. RFID improves the tracking of documents so that files can be more quickly located and legal document workflow more easily tracked. For sports events, concerts, and other leisure activities, RFID systems streamline ticket issue and validation. They also serve to minimize losses from ticket fraud. Tickets can be created on demand with RFID-enabled bar code printers; RFID card transponders can be issued to individual customers and enabled for specific time periods; and tickets can be read remotely to increase throughput at entrances and gates. A hands-free access system for ski lifts based on RFID is used at many ski resorts in Europe. This allows for improved customer service, more efficient operations, increased sales and higher throughput of customers. Remote-operated gates detect a valid ski pass, embedded with a Tag-it read/write transponder, and open automatically. The credit-card sized ski pass fits into a jacket pocket and never has to be removed, giving skiers the freedom to enjoy hassle free skiing.

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III. PROPOSED ALGORITHM

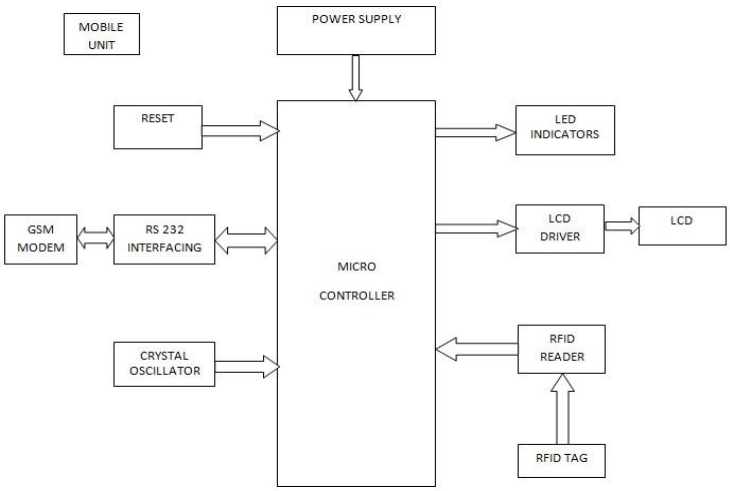

Fig 3: Block diagram of advanced secured postal communication using RFID

Controller circuit:

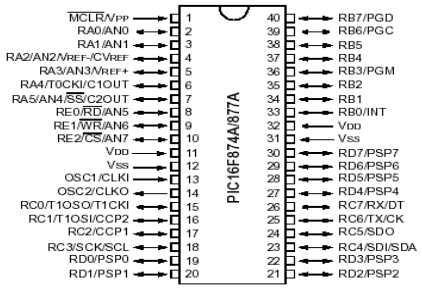

Fig 4: Pin diagram of PIC microcontroller

The PIC 16f877A microcontroller is a 40-pin IC. The first pin of the controller is MCLR pin and the 5V dc supply is given to this pin through 10KΩ resistor. This supply is also given to 11th pin directly. The 12th pin of the controller is grounded. A tank circuit consists of a 4 MHZ crystal oscillator and two 22pf capacitors are connected to 13th and 14th pins of the PIC.

The controller circuit consists of one RFID reader which is connected to RX and TX pins of the controller through MAX 232 IC. Here MAX 232 is used to convert the TTL logic to RS 232 logic and vice versa.

The circuit is designed for the delivery of postal cover's using RFID. On the delivery of the postal cover, the designated receiver will flash his tag on the RFID reader. If the person has authentication, then Green LED will glow, indicating Go-Ahead to deliver the postal cover. If the person is not designated then, Red LED will glow – indicating the warning. The date and time of the delivery will get stored in the Memory chip and can be accessed at any point of time.

Features of PIC Microcontroller 16F877A:

- Operating frequency: DC-20Mhz.
- Flash program memory (14 bit words):8K
- Data memory (in bytes): 368
- EEPROM Data memory (in bytes):256

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- Interrupts: 15
- I/o ports: A, B, C, D, E
- Timers: 3
- Analog comparators: 2
- Instructions: 35 and etc.

Power supply:

The power supply section is the important for any electronics circuits. To derive the power supply, the 230V, 50Hz AC main supply is stepped down by the step down transformer T1 to deliver a secondary output of 12V, 500 mA. The transformer output is rectified by a bridge rectifier comprising diodes D1 through D4, filtered by capacitor C1 and regulated by ICs 7812 (IC2) and 7805 (IC3). Capacitor C2 bypasses the ripples present in the regulated supply. LED1 acts as the power indicator and R1 limits the current through LED1.

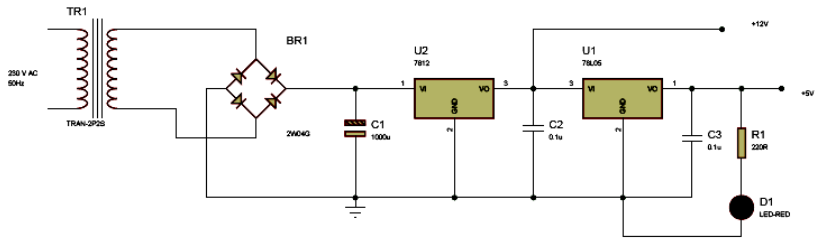

Fig 5 :Power supply

GSM:

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.

Fig 6: GSM Module

When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

- Single supply voltage 3.2v-4.5v
- Typical power consumption in SLEEP Mode: 2.5mA.

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- SIM300 tri-band
- MT,MO,CB, text and PDU mode, SMS storage: SIM card
- Supported SIM Card :1.8V,3V

IV. RESULTS

This device is capable of identifying the arrival of courier and forwards the same to the receiver and also sends an acknowledgement to the courier office so that they do not require the signature of the particular person for whom the courier is meant for. The basic idea of the system is to employ an RF ID tag to the courier and send the identity number to the receivers mobile. The receiver of the courier will have a letter box which has an RF reader and a dedicated GSM modem in it. As soon as the courier boy drops the letter in to it the RF reader reads the identity number of the tag and informs the same to a micro controller and compares it with the identity number send by the courier office and if both are one and the same then it sends message to the receiver and also to the courier office about the arrival of the courier.

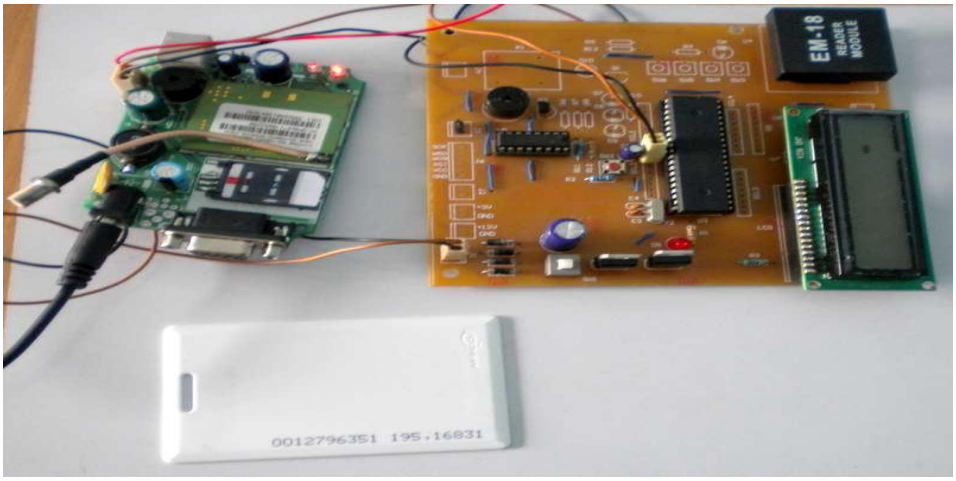

Fig 7**:** Advanced postal data communication system

V. CONCLUSION

Through this technology, one will be rest assured of the delivery of the material and even if there is a miss, still the material can be easily traced by using last received message to the mobile, thus **Secured Postal Data Communication.**

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BIOGRAPHY

P. Siva Nagendra Reddy is a Assistant Professor in the Electronics and Communication Engineering Department, Kuppam Engineering College, JNT University, Anantapuramu. He received Master of Technology (M. Tech) degree in 2013 from JNTU, Anantapuramu, A.P . His research interests are Wireless sensor applications, VLSI Technology etc.

K.Tharun Kumar Reddy obtained B.Tech in ECE from Kuppam Engineering College, Kuppam in the year 2012. He is pursuing M.Tech in Embedded Systems in Vemu Institute of Technology, P. Kothakota, Chittoor, A.P. His areas of interests are Embedded Systems, Microprocessors and Microcontrollers.

R. NARESH NAIK, received his Bachelor of Technology in Electronics and Communication Engineering in N.B.K.R. Institute of Science&Technology, Vakadu, A.P., INDIA in 2010. He is doing his research on Advanced DSP architectures. His areas of interests are doing VERILOG based projects.