KINDERGARDEN SECURITY SYSTEM USING GPS AND GPRS

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Abstract-: A GPS receiver is an accurate and precise navigational tool. The GPS module acquires positional data from the GPS satellites that includes measurements such as Latitude, Longitude, Altitude and Velocity. This data can be processed in myriad ways for use in various applications viz., military, architecture, surveying, transportation, recreation and sports. In this system an 8-channel GPS module is employed to acquire data from the satellites. It then sends this data to the microcontroller for further processing. The Microcontroller is an 8-bit high-speed device that is used in this paperto interface the GPS and the GPRS modules working at different speeds. The data are received from the GPS unit through the Trimble receiver. After converting them into a form suitable for transmission, they are sent to the server through the GPRS modem. Simultaneously, the information is also transferred to the LCD module for display in the Kit. This GPRS network has been used in this paper to transmit the positional information to the static IP. The present data are compared with the range of the kinder garden if the coordinates coincides within the range then the website can give the attendance to the student and the same time the location of the student inside the kinder garden campus can also be tracked by the observer and parents. Using the website, the parents can view their child attendance and also their current location using Google maps, where Google map plug-in were installed in our website.

Keywords: GPS satellites Latitude, Longitude, Altitude, Velocity**,** surveying, Google maps, microcontroller.

I. SCOPE OF THE PAPER

The kinder garden security system, based on GPS and GPRS technologies is designed. The scope of the paper is that it could also eventually be used as attendance system. This system is in fact designed to work as a security system as well as an attendance system. The children were sent to the kinder garden by parents. But the parents can't assure their child's security. For this purpose, our system is proposed to provide effective security and also the attendance for the children.The child's exact latitudinal and longitudinal location is obtained and used for security and attendance purposes. The parents are alerted using email when the child moves out of the kinder garden campus, hence the security is provided. In the meanwhile when the child enters the kinder garden campus, the attendance will be marked in the website. Hence the scope of the paper is realized.

OBJECTIVE OF THE PAPER

The main objective of the paper is to track the location of the students and simultaneously use the same system as attendance system by using Global Positioning System (GPS) and General Packet Radio Service (GPRS). This system provides effective security system and attendance system. Using the static IP, parents can view their child's attendance and also locate the child's exact location in the website.

II. LITERATURE REVIEW

BIOMETRIC FINGERPRINT ACCESS CONTROL SYSTEMS

In recent times, there are large numbers of Biometric Systems that are commercially available. Such Biometric systems are based on unique characteristics of human being. The most common, reliable and successful system is the one based on Finger Prints. Users are supposed to put their thumb/index finger (or any specified finger) in the finger reader. The system then compares the finger print that is read with that in the central database for authentication.Most of the Biometric Systems do not keep an image of the fingerprint but a template. A template is basically a number that is calculated based on various characteristics of the fingerprint. Such an approach is desirable so that unauthorized persons may not sneak in unauthorized images of finger print in the database. When a Finger print is to be matched, it's 'template' number is computed and compared with that stored in the database. Most systems allow for dry, greasy, chaffed and minor cuts on the fingers. The other biometric systems are based on 'Retina of the eye', Palm, photograph or voice pattern recognition. The Palm based systems take the image of the palm from various angles and compare the same. The system that is based on Finger Prints is most popular and economical. The core of Proximity system is the Proximity Reader and Proximity Card. There are two types of readers in the market - One that has an inbuilt controller with capability to authorize access with or without being connected to a PC. The other kind requires a PC to be connected at all times.Depending upon the configuration of the premises, one or more readers may be used. If more than one reader is used then it is called a Networked system, which is usually connected to a PC. Some systems use a 8 core or a 16

core wire for connecting all the Readers while some systems use only 2 core wire, thereby reducing the cost of wiring and maintenance. The better systems have readers that can be used interchangeably in a standalone or a networked configuration. Also, some systems have bulky controllers attached to the readers that require a separate source of power as well as add to the cost. The current day readers have built-in controllers and can be directly connected to a PC.Another use of Proximity systems is to record attendance for employees. For recording attendance, minimum two readers are required - one for IN and one for OUT. The employees are supposed to show their cards to the appropriate Reader upon arrival or exit. These transactions of IN and OUT are recorded in the attached PC. From the PC various reports can be printed.

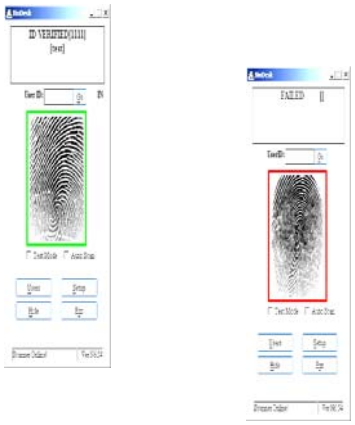
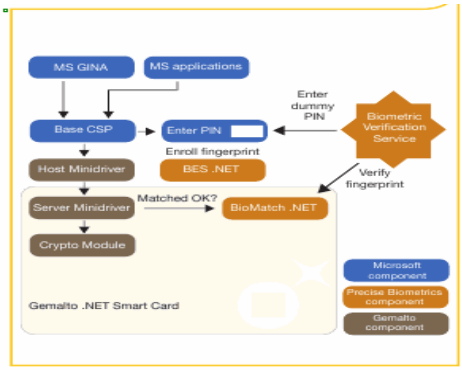


Fig: Fingerprint verification

The advanced Proximity Based systems come with inbuilt Password Based system too. It is possible to specify if the employees can enter using Password alone or Proximity Card alone or both are required. Such an option gives additional flexibility to define the Access Policy for the organization. Some other features of such systems are:Possible to define times of the day when the card is valid. Access granted if a valid Card is flashed and/or correct password is entered, provided the access is being attempted during the pre-authorized hours of the day. If an employee is under Duress to open the door then the Duress Entry option allows the opening of the door with alarm on the PC (if connected) Powerful software based on Windows OS that does not require a dedicated PC. Each Reader (one for each door) can be designated as an Incoming Door or an Outgoing door or an internal door or Exit on Duty door. Capacity Up to 1000 users (employees) each user can be assigned a Password and/or a Proximity Card Users are assigned to groups and privileges are declared at Group level for easy administration Possible to define IN/OUT time for a Group on the day of the week basis. Beyond the defined times the Controller will not grant access and will record the event in the PC as Access denied to. User Groups can be restricted to certain Controllers and the valid time zones can be defined for each day of the week Special alarm events (e.g. Forced entry) can be monitored on the PC Option to lock out Controller for one minute if three wrong attempts are made in one minute Changes in configuration settings can be easily downloaded to all Controllers easily for the PC.Even after Power failure, the Controller retains the last properties defined/downloaded on it. Even in case of PC failure, the Controller can continue to operate the Access control system using the last properties defined/downloaded for that Controller. However, recording of events in not possible in such a case Access denied events (e.g. employee trying to enter at odd hours) can also be recorded During entry option allows entry like normal entry but logs an alarm event on the central PC.

FINGERPRINT SCANNER IN BIOMETRIC SMART CARD READER

A biometric smart card protects biometric data and provides a reliable solution where there are privacy concerns. Fingerprints are an ideal credential for logical access control to computer networks and fingerprint templates never leave a smart card unprotected. Integrating a biometric sensor into a smart card reader makes sense because it is more convenient to combine a smart card reader with a fingerprint scanner in one integrated device. Fingerprint sensors in smart card readers enhance security by bringing the biometric sensor physically closer to the smart card system. In case of a "match on a card" (MOC) system, they stay inside the card from the time of first enrollment.



Smart card – biometric solution architecture

There are three factors in this authentication process: smart cards provide the "something you have" factor; the "something you know" is usually a PIN that must be entered to access a card; and, integrating a fingerprint scanner into a smart card reader increases security by adding "something you are" to the authentication process. Smartcards are ideal to store templates, make them portable and validate the identity of the card holder. Those templates can either be matched on the host system, on an intelligent smart card reader, or on the card itself via match on card (MOC).

III. EXISTING SYSTEM

Every morning the student attendance offers the first hand information of children safety. But sometimes it is complicated to exactly track the attendance since the

children arrive in a period of time in the morning and some of them come with their parents and some come by school bus. So we develop an active RFID attendance system to overcome the barriers and mistakes of manually taking attendance and combine the wireless GSM message service to provide real time responses to their parents' cellular phone. Parents can check the message and understand when their children are safely arrived. On the contrary, a noticing message will be broadcasted to administrators and parents if the children do not show up in a class on time so that the adults have the enough time to check out these particular children. The process happens in the existing system are

1. After a user press the button "connect ", the server will be connected to the reader.

2. At this moment , the reader starts reading tag ID number, and shows it in the tag ID column of a user' s operating interface .

3. After it is shown, the system will search for the related user's information in the database according to the tag ID number, such as the students' names, the parents' names and whose mobile phone numbers and so on. It will also write the information into the roll file in the database, and shows the result in the column of the user's interface.

4. If it is school time at that moment, the system will send a message to the parents to confirm that their children have arrived at school safely after it is shown.

5. If it is after school at that moment, the system will send the recording files related to the children to the media player list, and let the school broadcast the information on the campus. The system is an active RFID system of enhancing security for kindergartens.

Its configuration is shown the figure. When a student goes into the school, the reader will respond the student's tag and write his/her information into the roll file. At the same time, the system reads the information of the student and sends message to his/her parent through the massage sender.. Usage for an active attendance system – when entering school

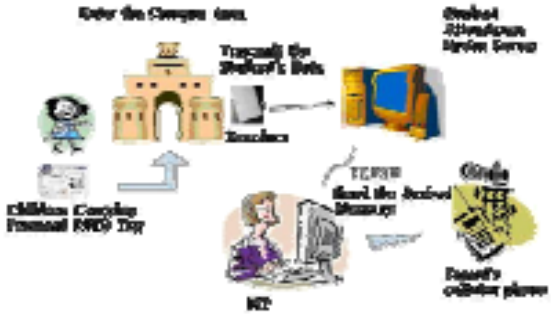


Fig: The system operations when entering school

The RFID electronic identification tag can be a student's nameplate. When a student in the kindergarten or in the elementary enters or leaves the campus, the reader established in the schoolyard will send a message to the school server, and another about "safe arrival " or "safe leaving " to his /her parent , which can let the parent understand the kid's whereabouts completely. Meanwhile, the school can also control the student's attendance condition. By doing so, it forms a better and safer electronic protection net.

The system operations when leaving school:

It illustrates the system used after school, the reader can respond the parent's tag away from about 50 meters, looking for his/her kid's information in the database, and read it out. After that, the system will put a recording file on the Media player list, and broadcast it through the school's broadcasting system in advance. After the kid hears the message, he/she can earlier get ready to be picked up by their parent outside the building so that their parent can immediately take their children without additional waiting. Consequently, the traffic congestion in front of the kindergarten is significantly relieved at rush hour after class.

Usage for an active attendance system – when leaving school

IV. PROPOSED SYSTEM

We have used a latest technology called GPS and GPRS. This system offers an approach to an integrated tracking safety and attendance system that integrates GPS and GPRS. This system includes avoiding trespassing and other activities across the kinder garden campus.we first collect the PVT data through GPS module. It will give the coordinates along the kinder garden campus. These data are collected and it is been fed to the system (website) which is been hosted in the internet. The GPS receiver refreshes the data continuously received from the satellites and it been sent to the static IP through GPRS.The value transmitted from the controller through the GPRS modem is been compared with the pre-stored databases if the coordinates coincides with the value stored in the database then the website can give the attendance to the student and the same time the location of the student inside the kinder garden campus can also be tracked by the observer.A GPS receiver is an accurate and precise navigational tool. The GPS module acquires positional data from the GPS satellites that includes measurements such as Latitude, Longitude, Altitude and Velocity. This data can be processed in myriad ways for use in various applications viz., military, architecture, surveying, transportation, recreation and sports. In this system an 8-channel GPS module is employed to acquire data from the satellites. It then sends this data to the microcontroller for further processing.The Microcontroller is an 8-bit high-speed device that is used in this paperto interface the GPS and the GPRS modules working at different speeds. The data are received from

the GPS unit through the Trimble receiver. After converting them into a form suitable for transmission, they are sent to the server through the GPRS modem. Simultaneously, the information is also transferred to the LCD module for display in the Kit. This GPRS network has been used in this paper to transmit the positional information to the static IP. The present data are compared with the range of the kinder garden if the coordinates coincides within the range then the website can give the attendance to the student and the same time the location of the student inside the kinder garden campus can also be tracked by the observer and parents. Using the website, the parents can view their child attendance and also their current location using Google maps, where Google map plug-in were installed in our website.

V. GPS MODULE

INTRODUCTION

The Global Positioning System or the GPS is a satellite based radio navigation system. It uses a constellation of 24 satellites to accurately pinpoint the locations on earth, anytime, anywhere. The GPS was originally developed for military use and has now evolved to commercial and civilian use. These days GPS is finding its way into cars, boats, planes, construction equipment, movie-making gear, farm machinery and even laptop computers. The GPS receiver needs data from at least three satellites at any one time to measure the location. Based on the data from the satellites the GPS receiver can provide information on velocity, time, direction and track of movement etc. The GPS receiver can be integrated with other systems such as a transmitter or a transponder. Our paper involves one such integration whereby, we integrate a GPS receiver with a mobile phone via a microcontroller.

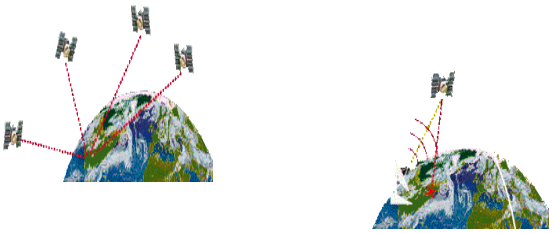


Fig. Measurement with four satellites

GPS Measurements

The process of positioning can be given in five steps.

a) Trilateration

b) Distance Measurement

c) Getting perfect timing

d) Pinpointing satellite positions

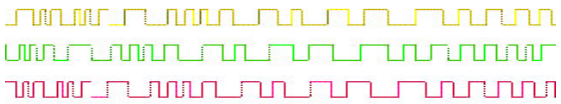
e) Error correction

a) Trilateration:

This is the basic principle behind the working of a GPS receiver. Assume we are in a location ‘x’ on the earth’s surface. Suppose we measure our distance to a GPS satellite and find it to be, say, 11,000 miles. This means that we can be anywhere on a sphere of radius 11,000 miles centered on that satellite.

Then we measure our distance to a second satellite andfind it to be, say, 12,000 miles. This means that we are on a sphere of radius 12,000 miles centered on the second satellite and on the intersection between the two spheres. Now our position is narrowed down to a circle in the intersection.

Now again if we measure our distance to a third satellite and find it to be, say, 13,000 miles we can say that we are somewhere on a sphere of radius 13,000 miles centered on the third satellite. Now our position is narrowed down considerably to the intersection of these three spheres, i.e. two points. Out of these, one of them will be ridiculous i.e. either it will be too far from earth or will be moving at a very high velocity. So, one of these points can be safely rejected and the other one gives our



location. But how do we measure the distance to a moving object viz., the satellite? That is the next step.

b) Distance measurement:

The distance measurement makes use of the basic principle of ***Velocity x Time = Distance***

Each GPS satellite has a unique Pseudo – Random Code. This code is a complicated sequence of ‘on’ and ‘off’ pulses. They are so complicated that they appear almost random. Hence the name Pseudo-Random.

The advantage of using such a complex signal is that it ensures that the receiver does not accidentally sync with any other signal. The pattern is so complex that there is very little possibility that any stay signal will have the same pattern. Since each satellite has a unique code this complexity ensures that the receiver will not pick up another satellite’s signal. So all the satellite can use the same frequency. Another advantage of this code is that it makes use of the information theory to amplify the incoming signal. Hence the receiver does not need expensive dish antennas to pick up the signal. This makes the GPS economical.

We have assumed that both the satellite and the receiver generate the signal at the same time. But how do we make sure that both of them are in sync? That is the next step.

c) Getting perfect timing:

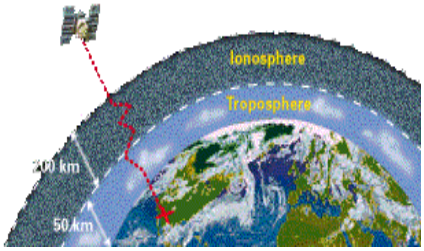
The satellites use an atomic clock installed on board to maintain accurate timing. An atomic clock uses the oscillations between the nucleus of an atom and its surrounding electron cloud to keep track of the time. The oscillation frequencies are determined by using mass of the nucleus, the gravity and the electrostatic spring between the positive charge on the nucleus and the negative charge of the electron cloud. These clocks give the highest degree of accuracy. This clock is a precision clock that depends on an electrical oscillator locked by the vibration frequencies of an atom for its operation.

The atomic clock is a very, very expensive clock and hence cannot be used in the GPS receiver.So to perfectly sync the satellite and the receiver, the receiver just makes a fourth measurement.

If this fourth measurement was made with an imperfect clock it will not intersect with the first three. This will alert the receiver to a discrepancy in the timing. The receiver then looks for a single correction factor that will make all the four spheres intersect at a single point. Once it has that factor it will apply this correction to all its measurements giving us atomic accuracy timing. But these measurements are not enough to measure our position. We further need to know where on space each satellite is, moment by moment. That is the next step.

d) Pinpointing satellite positions:

The satellites have a specific orbit each. The predictions of satellite positions are called ephemeris. The satellites have been injected into very precise orbits that are about 11,000 miles from earth. Such a high altitude ensures that the satellites will be free of the atmosphere and will orbit freely. And in the ground each GPS receiver has an almanac programmed into it, which has information about where each



satellite is, moment by moment.

But there might be some faults in the orbit due to gravitational pull of the sun or the moon. Such types of errors are called ephemeris errors. The satellites are constantly monitored by the US Department of Defense by using highly precise radars for ephemeris errors. If the DoD finds any errors (i.e. change in the position, speed, altitude of the satellite) it will transmit this information to the satellite. Then the satellite includes this correction in its pseudo-random code and relays it to the receivers.The GPS signals are not abstract but have to travel through a lot of hurdles. They are very much prone to errors due to the atmosphere and the ground. The correction of these errors is the next step.

e) Error correction:

Fig: Error due to atmospheric interference

The first type of error occurs due to atmospheric interference. When the signal travels through the ionosphere and the troposphere it gets slowed down a bit. One way to correct these errors is to predict the typical delay on a typical day. But the atmospheric conditions are not always typical. Another method is to compare the relative speeds of two different signals. This is called 'dual frequency' measurement and is a very sophisticated technique and possible only with advanced receivers.

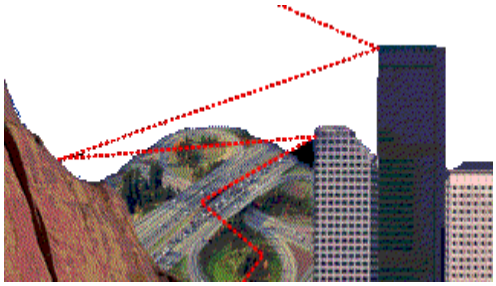


Fig: Error due to ground obstructions

The next type of error is due to the obstructions in the ground in the form of mountains, hills, large trees and buildings. This is called a multipath error and is minimized in good receivers by sophisticated rejection techniques.

The satellites are very precise but not perfect. They provide a slight ephemeris error and some minute discrepancies might occur in the atomic clock that translate to travel time measurement errors. These errors are minimized by a geometric principle called Geometric Dilution of Precision (GDOP).If the satellites are close together they provide a wide margin of error. The GDOP

principle involves the process of taking measurements from satellites that are far apart. In this case, they intersecting circles will be almost at right angles and this will minimize the margin of error. Good receivers determine the satellites that give the lowest GDOP and measure using them.In this section we will explain how GPS is put to use in our paper. The GPS receiver module we have used is Lassen SQ manufactured by Trimble. We have used this particular module since its comparatively cheap and, to quote Trimble, is a 'low-power micro sized GPS solution for mobile products'- which goes in well with our objective.The Lassen SQ GPS receiver is a single module encased in a sturdy metal enclosure.

Lassen SQ Receiver module

GPS Connectors

The module comes with two connectors. One is the RF connector through which the antenna is connected and the other, a mating connector for I/O mating. The antenna used by the GPS module is a Compact Magnetic-Mount GPS Antenna with a 5 m cable and an MCX connector. This antenna provides for a flexible, movable installation. The MCX output connector mates to the Hirose (RF) connector on the Lassen SQ GPS module with a RF transition cable.

GPS Antenna **System Architecture:**

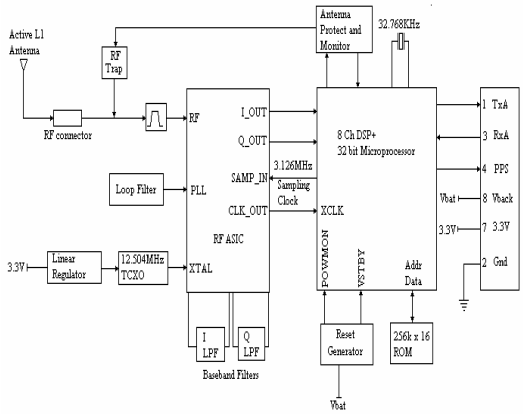


Fig: Lassen SQ Architecture

The Lassen SQ GPS receiver uses eight processing channels operating on the L1 frequency of 1575.42 MHz and using the coarse acquisition (C/A) code. The module uses custom integrated circuitry designed by Trimble to track the GPS satellite signals. TheseICs also contain support circuitry to the navigation processor. An integrated 32-bit microprocessor is used for tracking, computing a position, and performing the I/O operations. The Lassen SQ GPS receiver receives the amplified GPS satellite signals through the antenna feed line connector and passes them to the RF down converter. A highly stable crystal reference oscillator operating at 12.504 MHz is used by the down converter to produce the signals used by the 8-channel signal processor. The 8-channel signal processor tracks the GPS satellite signals and extracts the carrier code information as well as the navigation data at 50 bits per second. Operation of the tracking channels is controlled by the navigation processor. The tracking channels are used to track the highest eight satellites above the horizon. The navigation processor will then use the optimum satellite combination to compute a position. The navigation processor also manages the ephemeris and almanac data for all of the satellites, and performs the data I/O.

GENERAL PACKET RADIO SERVICE (GPRS)

Introduction

The General Packet Radio Service (GPRS) is a new nonvoice value added service that allows information to be sent and received across a mobile telephone network. It supplements today's Circuit Switched Data and Short Message Service. GPRS is NOT related to GPS (the Global Positioning System), a similar acronym that is often used in mobile contexts.

GPRS Network Architecture

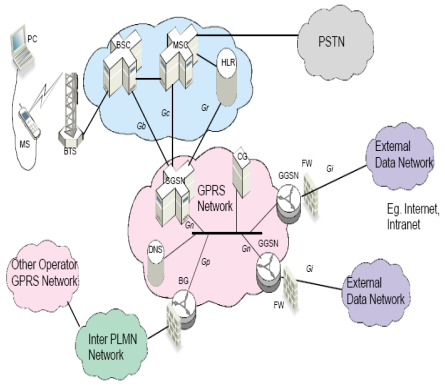


Fig: Architecture of GPRS

GPRS should improve the peak time capacity of a GSM network since it simultaneously:

- Allocates scarce radio resources more efficiently by supporting virtual connectivity;
- Migrates traffic that was previously sent using Circuit Switched Data to GPRS instead;
- Reduces SMS Center and signalling channel loading by migrating some traffic that
- previously was sent using SMS to GPRS instead using the GPRS/SMS interconnect that is supported by the GPRS standards.

For the first time, GPRS fully enables Mobile Internet functionality by allowing interworking between the existing Internet and the new GPRS network. Any service that is used over the fixed Internet today - File Transfer Protocol (FTP), web browsing, chat, email, telnet - will be as available over the mobile network because of GPRS. In fact, many network operators are considering the opportunity to use GPRS to help become wireless Internet Service Providers in their own right.

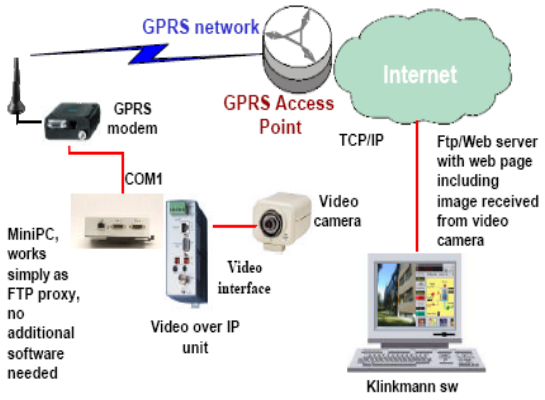


Fig: GPRS Connection

ARCHITECTURE DESIGN

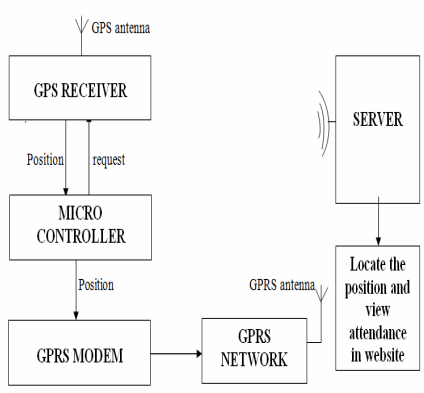


Fig: SYSTEM ARCHITECTURE DIAGRAM

The proposed system architecture is explained as follows: The Kit is provided with the child to track their exact location. The GPS receiver will track the current location from the satellites. The data received are in NMEA format. The required alone will be extracted and stored in the microcontroller. Through the GPRS modem those data are sent to the server. For that GPRS network should be established using the GSM Simcard. After connection establishment, through GPRS network the child's correct latitude and longitude position will be sent to the server very often.Using the static IP, the parents can view their child's attendance and also can view their child's current location through Google map. Even observer can monitor their students. If the child move out of the campus then the parents are alerted by sending e-mail to them about the attendance , time in & time out of their child.

BLOCK DIAGRAM

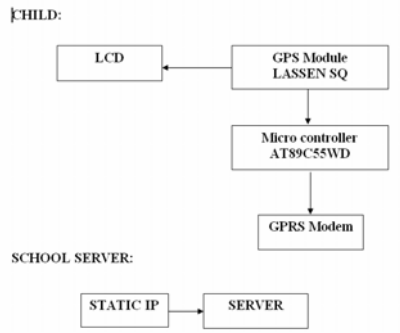


Fig: PROPOSED SYSTEMBLOCK DIAGRAM

In this paper, we first collect the position (latitude and longitude) data through GPS module. It will give the coordinates along the kinder garden campus. These data are collected and it is been fed to the system (website) which is been hosted in the internet. The controller refreshes the data continuously received from the GPS and it been sent to the static IP through GPRS. The value transmitted from the controller through the GPRS modem is been compared with the pre stored databases if the coordinates coincides with the value stored in the database then the website can give the attendance to the student and the same time the location of the student inside the kinder garden campus can also be tracked by the observer.

VI. CONCLUSION

As the world is moving forward to a new era of pursuing money, security threats are raised. In this paper, we provide security system for kinder garden using GPS and GPRS technologies. The GPS device is provided with the child. The GPRS network used to send the position to the server. Using Static IP, parents can view their child's attendance and track their location using Google map. We have introduced the concept of email gateway in web services to send email for parents about their child's present status. The paper discusses on how the Google map are used to view the location of the child. Also the facility for viewing attendance for the child by their parents using the static IP is implemented by entering the login details. This serves an effective method considering the cost, time as well as parents satisfaction.

VII. FUTURE ENHANCEMENTS

As with the development of the security system and its related technology this papaer is a very dynamic and user friendly which blends with the need and the great deal of requirements of the individual user .This papaer has been developed with the ideas of email gateway and Google map connectivity. To make things feasible there are certain other fields like leave letter submission, online

video conference, online fee payment and remark subscription where the same technology can be implemented in future.

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