Implementation of Gas Detection System Using Unmanned Moving Vehicles and Tracking

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Abstract: **Unmanned aerial vehicles are nowadays argubly employed in civil applications. One of the most promising applications is the environmental monitoring .We propose a battery-powered eNose board that can be embedded with any type of vehicle. We evaluated the effectiveness of the sensing method by means of field experiments using the prototype as payload of a vehicle . The results show that the analysis of the target environmental parameters is not perturbed by the air flow generated by propellers. The system is suitable for any type of vehicle… we Developed an optimal monitoring algorithm for gas leakage, temperature, humidity and localization and send the data to particular mobile number using gsm..**

Index Terms—*Location, Assisted GPS, gsm,temperature sensor,humidity,light intensity Cloud offloading, Coarse-time Navigation*

I.INTRODUCTION

Localization is a fundamental service in mobility. In outdoor applications such as wildlife tracking [22], [20], participatory environmental sensing [15], and personal health and wellness applications, GPS is the most common location sensor. GPS receiving, although becoming increasingly ubiquitous and lower in cost, is processing intensive and energy-consuming. Take ZebraNet sensor nodes [22] as an example. On average, one GPS location fix requires turning on the GPS chip for more than 25 seconds at 462mW power When a GPS chip is turned off completely for more than a few minutes, the previous code phases and Doppler information are no longer useful, and the device must spend substantial energy to re-acquire the satellites. 4) Post-processing and least-square calculation require a powerful CPU. In this paper, we address the problem of energy consumption in GPS receiving by splitting the GPS location sensing into a device part and a cloud part. We take advantage of several key observations.

Many mobile sensing applications are delay

consumption, which dominates its energy budget. As a result, the unit is equipped with a 540-gram solar cell array and a 287-gram 2A-h lithium-ion battery in order to support one GPS position reading every 3 minutes. Power generation and storage accounts for over 70% of the sensor unit's total weight of 1151 grams. Similarly, in wearable consumer devices such as fitness trackers, high energy consumption from GPS receivers mean bulkier devices and low battery life. As we will elaborate in section 2, there are two main reasons behind the high energy consumption of GPS receivers: 1) the time and satellite trajectory information (called Ephemeris) are sent from the satellites at a data rate as low as 50bps. A standalone GPS receiver has to be turned on for up to 30 seconds to receive the full data packets from satellites for computing its location. Even in assisted GPS, where ephemeris is sent to device through a separate channel, a receiver needs to run for about 6 seconds to decode time stamps. 2) The amount of signal processing required to acquire and track satellites is substantial due to weak signal strengths and unknown Doppler frequency shifts. For example, in state-of-the-art GPS receivers such as u-Blox Max-7, the acquisition state consumes 60mW and can take on average 5 seconds to yield the first location fix. In order to save the energy spent on acquiring the satellites, some GPS receivers have a low power tracking mode to keep track of the satellite information. In case of Max-7, the low power tracking mode consumes more than 12Mw continuously. 3) The satellites move at high speed

tolerant. Instead of determining the location at the time that each data sample is collected, we can compute the locations off-line after the data is uploaded to a server. This is quite different from the turn-byturn navigation scenario that most standalone GPS devices are designed for. The benefit is even more significant if the data uploading energy is amortized over many data samples.

Much of the information necessary to compute the location of a GPS receiver is available on line. For example, NASA publishes satellite ephemeris through its web services, so the device does not have to stay on long enough to decode them locally from satellite signals. The only information that the device must provide is a rough notion of time, the set of visible satellites,

and the "code phase" information from each visible satellite. Code phases can be derived from any millisecond of satellite signal. If we can derive location without decoding any data from the satellites, there is significant opportunity to duty-cycle the receiver. In comparison to the constraints on processing power and energy consumption, storage is relatively cheap to put on sensor devices, so we can liberally store raw GPS intermediate frequency (IF) signals together with sensor data. For example, at an IF of 4MHz, sampling a one-millisecond signal at 2-bit resolution and 16MHz rate results in 4KB raw data. Due to the split between local and cloud processing, the device only needs to run for a few milliseconds at a time to collect enough GPS IF signals and tag them with a rough time stamp. A cloud service can then process the signals off-line, leveraging its much greater processing power, online ephemeris, and geographical information to disambiguate the signals and to determine the

EXISTING METHOD:

The main pollutants from vehicles are the oxides of carbon and nitrogen, which can be easily detected these days with the help of semiconductor gas sensors. The existing system has data collection and remote sensing using GPS. A mobile robot equipped with embedded systems can collect environmental samples with a much denser spatiotemporal resolution than a human operator also resulting in a safer working condition. Pollution and urban air quality are the major environmental risks to public health. Gas emissions are responsible for a variety of respiratory illnesses and environmental problems, such as acid rain and the depletion of the ozone layer. Pollutants may be released as exhaust gases from traffic or industry and fires or as a consequence of accidents with chemicals.

PROPOSED METHOD:

The process of working of this project is explained as follows. The total equipment of this project is placed inside a vehicle. Here we have GPS (Global Positioning System) module by which we can get

other is to use deployed infrastructure. Public infrastructure includes GPS, Wi-Fi access points9 , and FM radio stations [4]. When the system includes deployed nodes to assist localizing mobile nodes, signals like RF [5], sound/ultrasound [17], [3], [19], and magnetic coupling [11], [7] can be

location of the receiver. We call this approach Cloud-Offloaded GPS (COGPS).

The CO-GPS idea is built on top of a GPS receiving approach called Coarse-Time Navigation (CTN) [21]. While CTN is used for quickly estimating the first location lock (measured as Time To First Fix, or TTFF), we are the first to articulate and quantify its energy saving benefits. Furthermore, we find ways to relax the condition on knowing a reference location that is close to the true location, and maintaining a real-time clock that is synchronized to the satellite clock. As a result, COGPS receivers can have an extremely short duty cycle for long-running tracking applications. This paper extends [10] by investigating ways to remove satellite detection outliers, which are more likely to be false positives due to weak signal strength and short signal length. As a result, through our empirical evaluation over 1500 real GPS traces, median location error drops from 30m to 12m, and more than 85% of samples have less than 30m error. Furthermore, we removed the dependency on relatively energy-consuming WWVBbased time synchronization, and leverage time stamps resolved from GPS signals themselves to progressively time stamp samples in data traces. A node only needs to be time synchronized once at the beginning of its deployment.

the location of the vehicle, the location values are displayed on the LCD (Liquid Crystal Display). In this project we have sensors which are interfaced to the micro controller. Those are gas sensor through which we can detect the gas from the vehicle. These values are also displayed on LCD. Here ADC (Analog to Digital Converter) is used to convert the analog data from the sensors to digital form. Whenever these values exceed the threshold then intimation is given to the RTA including vehicle's exact position. The motor getting stopped if it exceeds the threshold value then send sms to owner number.

II.RELATED WORK

Location sensing is a basic service in sensor networks. In most outdoor environments and for stationary used as propagation media to provide distance or angle measurements. Our method falls into the first category of using publicly available infrastructure. CO-GPS is based on a rich body of work in GPS [14] and A-GPS [21]. With their integration into mobile phones, GPS and A-GPS

have increasingly become low cost, low power and highly accurate. have the processing power or energy to compute code phases locally. So the CO-GPS design removes all computation from the device and reduces the amount of captured data to the minimum necessary for a reliable signal. Our approach of using Doppler shifts to estimate the rough location of the receiver is related to the approach used in mobile transmitter tracking systems such as Argos10, which is used in applications such as wildlife tracking and environmental monitoring. Argos uses multiple signals sent by a mobile transmitter to a single satellite over a given time interval. The satellite uses the varying Doppler shifts of these signals to infer the angles of arrival, which define cones with the satellite at their apex at each signal time. The intersection of these cones gives the location of transmitter. In general, the accuracy of Argos is within a few kilometers [2]. COGPS uses the same principle in the reverse way. We use multiple simultaneous signals sent by different satellites, and from these we determine the Doppler shifts, angles of arrival, and the cones that we intersect to guess the location of the GPS receiver.

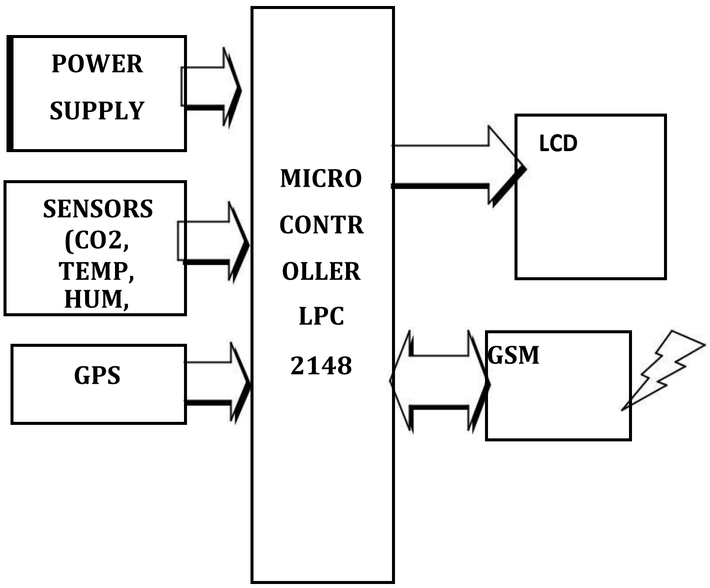
III. CO-GPS DESIGN

The design of Cloud-Offloaded GPS (CO-GPS) leverages the CTN principle but removes the dependency on nearby landmarks. For embedded sensors without cellular connections that are expected to have high mobility over their lifetimes, it is not always possible to provide nearby landmarks. Our key idea is to leverage the computing resources in the cloud to generate a number of candidate landmarks and then use other geographical constraints to filter out the wrong solutions. In this section, we assume that the device is reasonably synchronized with a global clock. We

sensors, researchers usually assume the locations are set using GPS at deployment time. For mobile sensors, there are two classes of solutions: one is to use public infrastructure

However, for embedded applications such as wearable devices and animal/asset trackers, the mobile-phone-based solutions are too energy hungry [9], [16]. u-Blox published a white paper [12] in 2010 that is closely related to our cloud off loaded GPS approach. However, in that design for digital photography, every geotag consists of 200ms of GPS raw signal. LEAP [18] is our first attempt to move GPS location calculation to the cloud. In contrast to CO-GPS, LEAP relies on the local processing power on mobile phones to derive the code phases. In our embedded sensing applications, the device may not will relax this condition later. When the device needs to sense its location, it simply turns on the GPS receiving front end and records a few milliseconds of GPS signal . Our goal is to derive the receiver location offline solely from the short signal and the coarse time stamp. Shadow Locations:- The challenge of deriving receiver location with no reference landmark is the possible outliers, which we call shadow locations. Figure 1 illustrates this concern using two satellites. Here, we model the pseudo ranges from each SV as a set of waves, each 1 light-ms apart. Clearly, these waves intersect at multiple locations.

Since we do not know the exact millisecond part of the propagation delay, all intersections, A, B, C, D, ...are feasible solutions, even though only one of them is the correct location. When more satellites are visible, more constraints are added to the triangulation, which helps resolve the ambiguity. However, a larger number of satellites alone is not enough. To illustrate this empirically, we take a 1ms raw GPS trace and apply CTN with an array of landmarks across the globe. There are 6 satellites in view. The landmarks are generated by dividing the latitude and longitude with a 1 o resolution around the globe. In other words, we picked 180 × 360 = 64, 800 landmarks with adjacent distance up to 111km on the equator. Figure 2 shows the total of 166 converged points.



The first step in eliminating shadow locations is to reduce the number of possible landmark guesses. Of course, if we know the past location of the sensor and can assume that it has not moved more than 150km between the samples, then we can use the past location as the landmark. However, in the bootstrap process, or when the time difference between readings is large enough to allow movement greater than 150km, we have to assume no prior knowledge of the location of the sensor. Following the acquisition process, we have the set of visible satellites and the frequency bin (identifying the Doppler shift) for each satellite.

Knowing the signals' transmission frequency, the two additional benefits. First, it can avoid temporal interference to GPS signals. Secondly, in hardware implementation, the CPU can have time to write buffered signals to the storage between chunks. We use multiple chunks, and the code phase and Doppler derived from them, in two ways. First, we eliminate satellites whose code phases have too much variance across all the chunks, compared to other satellites. Secondly, we form a joint Least Squares problem using all remaining satellites, which provides an effective mechanism to combine the information from all chunks into a single optimization formulation. We detail these steps as follows. Due to short signal lengths, some code phases and Doppler frequencies may have incorrect values. Adding them into the optimization equations introduces erroneous constraints and causes large location errors. We employ the following useful observation in detecting code phase outliers. For Doppler shifts tell us the relative velocity between the satellites and the receiver. If we know the absolute velocities of the satellites, which can be obtained from the ephemeris, then we can derive each angle between the satellite and the receiver, which defines a set of intersecting cones, as illustrated in Figure 3.

Improving Location Accuracy:-

A key design consideration of CO-GPS is the tradeoff between accuracy and energy expense. GPS signals are very weak when they reach the Earth's surface, and they suffer from multi-path errors and obstruction by objects. Typical GPS receivers use long signal durations and tracking loops to overcome the low signal quality and to improve location accuracy progressively. Notice that the longer the signal is, the more robust the correlation spikes. This is essential for standalone GPS receivers, since they need to subsequently decode the packet content, which requires good signal quality. However, sampling and storing large quantities of raw data brings energy and storage challenges to embedded sensor devices. In COGPS, the only information we can acquire from the signal are the code phases and Doppler shifts. However, the short length of the signals presents a challenge in reliably recovering the desired information, and errors in code phase directly contribute to location error. Here we explore an approach to improve the accuracy by using multiple chunks of signals at a single location. Taking multiple chunks h

each chunk, code phases corresponding to different satellites are sampled simultaneously by definition.

IV.CLOUD SERVICES

The cloud portion of CO-GPS, called LEAP, has two main responsibilities: to update and maintain the ephemeris database, and to compute receiver locations given GPS raw data. We implemented these services on the Windows Azure cloud computing platform to achieve high availability and scalability.

Location Service:-

LEAP is a web service that has three main components (Fig. 5): a request receiver frontend, a localization service, and an ephemeris service. The request receiver is the front end of the service, implemented as an Azure Web Role. It receives raw GPS traces from clients, together with a time stamp, parameters for sensor configuration, and an optional reference location. Because satellite acquisition is time consuming, LEAP is implemented as an asynchronous service. It enquires each sample for acquisition and location processing and returns a request ID to the client, who later queries the web service with this ID to obtain the computed location result for the sample. Each sample is one location point. The localization service is implemented as an Azure Worker Role that dequeues GPS samples and processes them. The processed results are stored into an Azure table for later retrieval when the client queries the results for a request ID. The localization service implements GPS satellite acquisition, course time navigation, and least square procedures on .NET using C# and Sho4. We aggressively use multithreaded parallelism to achieve better scalability.

V.DISCUSSIONS

This paper focuses on the sensor and cloud service designs of CO-GPS. But in real applications, some related aspects must be considered as well.

Communication:

In real applications, the GPS samples must be sent to the cloud. There are many ways to do this. In the previous discussion, we assume that either the device can be connected to a computer to upload the data via a USB port, or the micro-SD card can be retrieved for post processing. In those cases, no communication energy is needed in the untethered mode. In other cases, if the mobile device returns to a known location, e.g. human homes, animal nests, or known paths, one can set up radio infrastructure to retrieve the data. Bluetooth, Bluetooth Low Energy (BLE), and IEEE 802.15.4 (e.g ZigBee) are all possible low-power communication solutions. These radios typically use 10mW transmission power. The actual choice may depend on the range, data volume, and cost constraints. WiFi, cellular network, or FM radios are also possible for longer range communication. These radios typically run at more than a few hundred milliWatts active Power, and often require substantial start-up energy. In these cases, depending on how much this energy expense is amortized by the amount of data in a single upload session, the energy benefit of cloud offloaded GPS may be diminished by communication cost.

Time-Synchronization:

This paper designs an incremental time synchronization approach to leverage derived time stamps from GPS samples. This requires the real-time clock on the device to run continuously. In applications where this is not possible or is undesirable, one may consider a device independent time-synchronization design. In [10], we designed a solution based on WWVB radio broadcast. WWVB signals can be received with very low energy. However, it required a large antenna, which adds size and weight to the sensors.

VI.CONCLUSION

Motivated by the possibility of offloading GPS processing to the cloud, we propose a novel embedded GPS sensing . By using a coarsetime navigation technique and leveraging information that is already available we show that 2ms of raw GPS signals is enough to obtain a location fix. By averaging multiple such short chunks over a short period of time, CO-GPS can on average achieve < 20m location accuracy using 10ms of raw data (40kB). Without the need to do satellite acquisition, tracking and decoding, the GPS receiver can be very simple and aggressively duty cycled. We built an experimental platform using a GPS front end, a serial to parallel conversion circuit, a microcontroller and external storage. When fire accident happened or high humidity, detecting gas those data will be forward as a message to registered mobile number. On this platform, sensing a GPS location takes more than orders of magnitude less energy than self-contained GPS modules.

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