AOT BASED MULTIPURPOSE ROBOT

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ABSTRACT

The development of a prototype of an autonomous controller based on AOT (Android Things) mobile robot system for multi- purpose surveillance & detection and localization. The progress came up with the system that is able to perform scrutiny tasks in industrial and military purpose when it is complicated to access unsafe and insecure areas directly without involving the human presence. The robot can be used for routine inspections of facilities or for targeted inspection of specific system components. This work describes about the design, construction and fabrication of multi-purpose field surveillance robot whose objective is to avoid implementing serious manual risks. The utilization of metal sensing system can be processed in defence platforms. The robot is dealt with multimode operations of roaming. Roaming facility is performed using ultrasonic mechanism. The development of innovation and monitoring process that make the most of state of art measuring and automation technology as well as robotics promises improvement in the reliability, efficiency and cost effectiveness of inspections.

Keywords: *Android of things, Maximum likelihood estimation,Time of arrival, Time difference of arrival.*

1. INTRODUCTION

With the rapid development of petrochemical industries in recent years, the interest in gas leak detection and localization has increased due the loss of life, injuries, and damaged equipment caused by the toxic gas leakage. Apart from the manufacturing and production point of view, real-time information about the distribution area of hazardous toxic gases in large-scale industry is needed to ensure safety precaution for the first-line working staff during various operations in production, storage, transportation, and usage. Thus, gas leakage source estimation continues to be a major part of intelligent industrial sensing systems.

2. LITERATURE REVIEW

1. **Fixed Cable-Based Sensing***:* Traditional monitoring system consists of high resolution sensors with fixed installation. The sensor data is sent to the control center through long- distance cables, which results very high cost. Deploying a large number of fixed cable- based sensing devices is not cost-effective in a very large monitoring area.

2. **Big Mobile Robots***:* Expensive mobile robots are used to localize underwater gas leakage. Generally, these robots are designed in large size with good mobility, however, require very high cost for manufacturing as well as maintenance. Since the localization in robot-system is

difficult due to its high degree of mobility, the high cost restricts further applicability in the large-scale monitoring.

3. **Small Autonomous Mobile Robots, Called as Electronic Nose***:* Small size autonomous robots with low complexity and high mobility are widely used for sensing continuous objects. The smell and biochemical sensors in a single robot measure the gas density and estimate the direction as well as velocity of the gas diffusion. The collaborative biochemical gas source localization is based on adaptive swarm intelligence. This localization scheme forms an autonomous group by more robots that have a wide coverage. However, the mobility of these robots is limited by the energy consumed by a long time in the large area. As the gas leakage source is estimated according to the wind field distribution, the localization accuracy is depends on the environmental factors, e.g., wind speed and wind direction.

4. **WSN-Based Localization and Tracking***:* Wireless sensor networks (WSNs) are multi- hop systems with randomly deployed sensor nodes in the monitoring area. The gas concentration, diffusion direction, speed, and other physical parameters are measured by various senor nodes.

Moreover, the study on boundary estimation of continuous objects has become popular in the last decade. We also present a detailed survey on boundary detection and tracking algorithms proposed in the literature. In addition, this survey highlights the research issues of localization and boundary tracking of continuous objects in large-scale industries and environments.

3. TYPES OF LOCALIZATION

GAS SOURCE LOCALIZATION:

Continuous target localization and tracking are two major research issues in WSNs applications. Target tracking is applied to various applications, e.g., military, anti- terrorism, anti-riot, industrial and environmental monitoring, and the like. Here, we focus on gas leakage source localization, which belongs to the continuous target localization based on WSNs. However, constrained by physical size of sensor nodes, hard-to-reach area, and short distance wireless charging due to high interference, limited battery-powered sensor nodes bring major challenges in localization and tracking operations.

The gas leakage source localization algorithms with WSNs are categorized as follows: *acoustic signal*- and *gas diffusion model*-based localizations. Acoustic signal-based localization method, which uses acoustic signal for localization, provides instantaneous leakage information.

In addition, this method consumes a small amount of communication energy due to low sampling rate. The source location is obtained through analyzing and processing the acoustic information of each node in the gas leakage area.

MAXIMUM LIKELIHOOD ESTIMATION (MLE):

Maximum likelihood estimation (MLE) algorithm uses the distance between a source and each beacon node to obtain the nonlinear equations according to 2-D space-distance formula. This method approximates the source coordinate using the minimum mean square error (MMSE) estimation method. As MLE is a centralized method, the detected values from all the nodes must be sent to the fusion center for estimation.

ULTRASONIC-BASED LOCALIZATION:

At present, many literatures implemented some improvements for the localization algorithm such as localization accuracy, computational complexity, and energy consumption.

Masazade et al. proposed an energy efficient iterative method to improve MLE algorithm. This method reduces the energy consumption in a network because the sensor data is quantized before transmission. Actually, the network uses anchor nodes to obtain the coarse location estimates, then employs a few additional sensor-data to refine ML estimates through an iterative algorithm with an update in posterior Cramér-Rao lower bound (PCRLB).

Since in real applications, MLE is effected by the noise,Liu et al. proposed a model combined with Gaussian and impulse noise model that consider the contamination of outliers in these acoustic measurements. Afterward, a noise-aware MLE was proposed to achieve source localization with the Cramér-Rao bound (CRB). This model was provided to show how the estimation performance is improved with a location estimator using quantized binary data and channel statistics.

Low complexity and global optimal solution are obtained without any fusion center. Furthermore, this non-convex problem was relaxed as a convex semide finite programming (SDP) for a better estimation with a randomization. Recently, particle swarm optimization (PSO) is extensively used to solve this above problem. For instance, MLE uses the light-weight dynamic population in PSO-based grid strategy method to accurately estimate the source location with reduced energy consumption.

For the multi-source localization, MLE determines the source-to-sensor distance using acoustic sensors. An acoustic energy attenuation model was designed to

derive CRB. The impact of various deployment strategies was investigated in for localization accuracy. To overcome the drawbacks of the centralized EM algorithm, Meng et al. proposed distributed expectation maximization (EM) algorithm. Since energy consumption- based MLE is non-convex, a global solution is rarely obtained without a good initial estimates. **3.2.2GAS DIFFUSION-BASED LOCALIZATION:**

The location estimation of a plume source using the MLE algorithm was studied in. Mitra et al. proposed CH4source localization using MLE, which estimates the related explosion-threat in an indoor environment. It is observed that this

localization method estimates more accurate location when a subset node is selected. Thus, the error estimation in the above algorithm is satisfactory for various single source points. However, considering the high computational complexity in MLE, a real-time approximated ML estimator (RTAMLE) is discussed where the diffusion of a gas source is estimated based on a binary observation. The estimation performance of the RTAMLE is close to MLE with a significant reduction in computational complexity when the node density tends to infinity. Levin book and Wong showed an excellent estimation performance by using MLE and RTAMLE with binary observation made by the active sensor
nodes. Thus, this approach is suitable for the real-time processing due to its reduced complexity.

NON LINEAR LEAST SQUARES (LS) OPTIMIZATION:

Nonlinear least squares (LS) optimization estimates the non-linear static -model parameters based on minimum sum of squared error. It uses a sophisticated optimization algorithm to solve the nonlinear location estimation problem.

3.3.1ULTRASONIC-BASED:

To estimate the distance between a leakage-source and sensors, Li and Hu designed an acoustic micro-sensor array with an energy-decay model. The source locations are realized by the MLE. After that, the energy readings are compared to solve this nonlinear LS problem.
Although, this method is robust against
localization errors and energy decay factors, is more sensitive to the sensor-gain calibration.

LASER-BASED:

The laser-based algorithms found in the literature mainly exploit top-down visual attention mechanism (TDVAM) combined with shape analysis to localize gas sources in the large- scale outdoor environments. Mobile robots capture images at different horizontal angle with an on-board tilted camera. In each image three salient regions are computed using this TDVAM. One plausible gas source is identified after the shaping analysis on these salient regions. A laser range scanner is used to determine the position of recognized plausible gas source.

GAS DIFFUSION-BASED:

Many researchers used gas diffusion model to solve nonlinear LS optimization for the plume source localization. Sucha method is discussed in which assumes an uniform propagation of the plume in environment. To minimize the least squares error, a two-step approach is discussed with a known homogeneous wind field and isotropic diffusion.

TRILATERATION ALGORITHM:

Trilateration algorithm, which is an another type of localization algorithms, calculates the location according to the coordinates of three beacon-nodes and the distance between the beacon-node and the target.

DIRECT TRILATERATION (DT)-BASED:

Kuang and Shao studied the direct trilateration (DT)- based source localization algorithm that provides better accuracy compared to the MLE in a plume source localization at low noise level. To handle a stronger background noise than conventional DT algorithm, a robust plume source localization algorithm is designed based on an weighted combination in trilateration algorithm. The ETDT algorithm that combines trilateration measurement with weighted centroid method considers an angular weighted function to further reduce the localization error.

TIME-OF-ARRIVAL (TOA):

A time-of-arrival (TOA) method calculates the distance between nodes according to the signal propagation time. The trilateration method is used to estimate the source position with a known signal propagation speed. As a centralized scheme, this method has low energy efficiency and low scalability due to the excessive radio transmissions. In addition, as the sink node is overloaded with the data traffic in the centralized scheme, the network lifetime becomes a critical issue. To prolong the network lifetime, a distributed processing is proposed where many intermediate estimates (IEs)are used in some of the active nodes.

TIME DIFFERENCE-OF-ARRIVAL (TDOA):

Time difference-of-arrival (TDOA) method, which locates the emission signal source by measuring the time lag between the radio signals transmitted to different monitoring centers, is a nonlinear localization method. As relative time is used for localization, the time synchronization issue can be relaxed. Wang and Chen suggested a localization method based on the TDOA scheme that considers the non-convex optimization problem. Monte-Carlo sampling method is used to achieve an approximate global solution of the ML estimation in a line-of- sight (LOS) environment. It is noted that this method outperforms several existing methods with the CRB accuracy.

WEIGHTED CENTROID ALGORITHM:

The geometric centroid of polygon is treated as a source localization by the weighted centroid algorithm. The polygon is the overlapping area of the beacons where the unknown node share within the scope of communications. This algorithm is designed to be simple, however, is not widely used due to low estimation accuracy. In addition, this algorithm cannot accurately estimate the source location with the non lineargas diffusion model in a windy condition. Qiuming et al. proposed a localization method that combines the advantage of particle filter with the weighted centroid algorithm. An improved position estimation is observed by the rigorous simulation results.

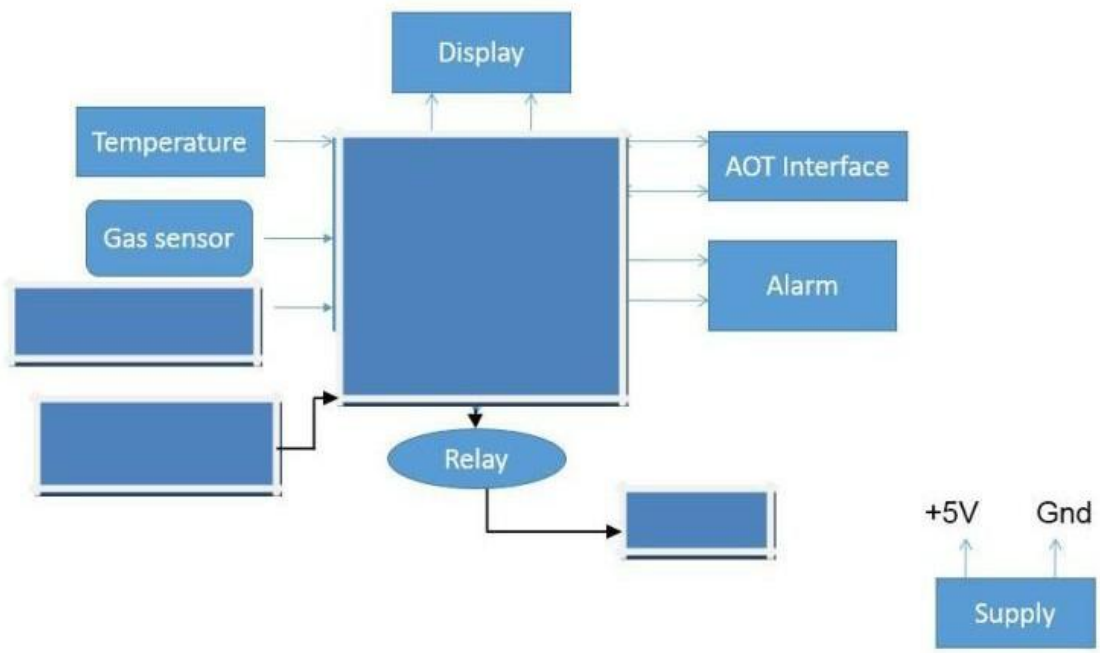
3.7 PROJECTION ON CONVEX SETS (POCS):

A distributed source localization method is proposed based on convex sets. Assume that the communication link between the nodes as a geometric constraint of the node location, whole network is modeled as a convex set.

3.PROPOSED SYSTEM

Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses, cars. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places. The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane (C3H8) and butane (C4H10). Gas leakage system consists of GSM (Global System for mobile communications) module, which warns by sending SMS. However, the former gas leakage system cannot react in time.

BLOCK DIAGRAM



Android Things (codenamed Brillo) is an Android-based embedded operating system platform by Google, announced at Google I/O 2015. It is aimed to be used with low-power and memory constrained Internet of Things (IoT) devices, which are usually built from different MCU platforms. As an IoT OS it is designed to work as low as 32–64 MB of RAM. It will support Bluetooth Low Energy and Wi-

Fig.3.2 Along with Brillo, Google also introduced the Weave protocol, which these devices can use to communicate with other compatible devices Google provides OEM implementations of Android Things designed for the production of Google Assistant-powered smart speakers and displays running one of two Qualcomm "Home Hub" systems-on-chip. Products have been developed by JBL, Lenovo, and LG Electronics.

SOFTWARE DESCRIPTION

Software Used: Proteus 8 professional

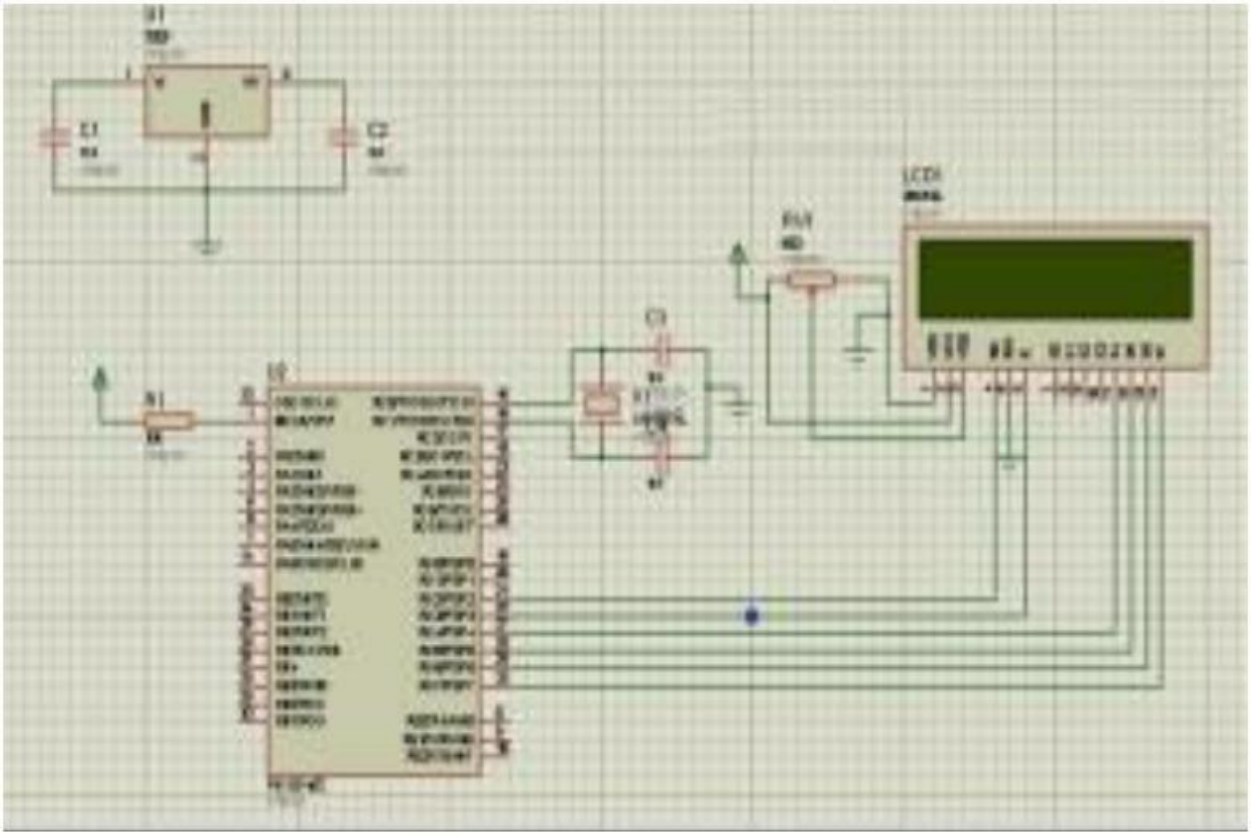
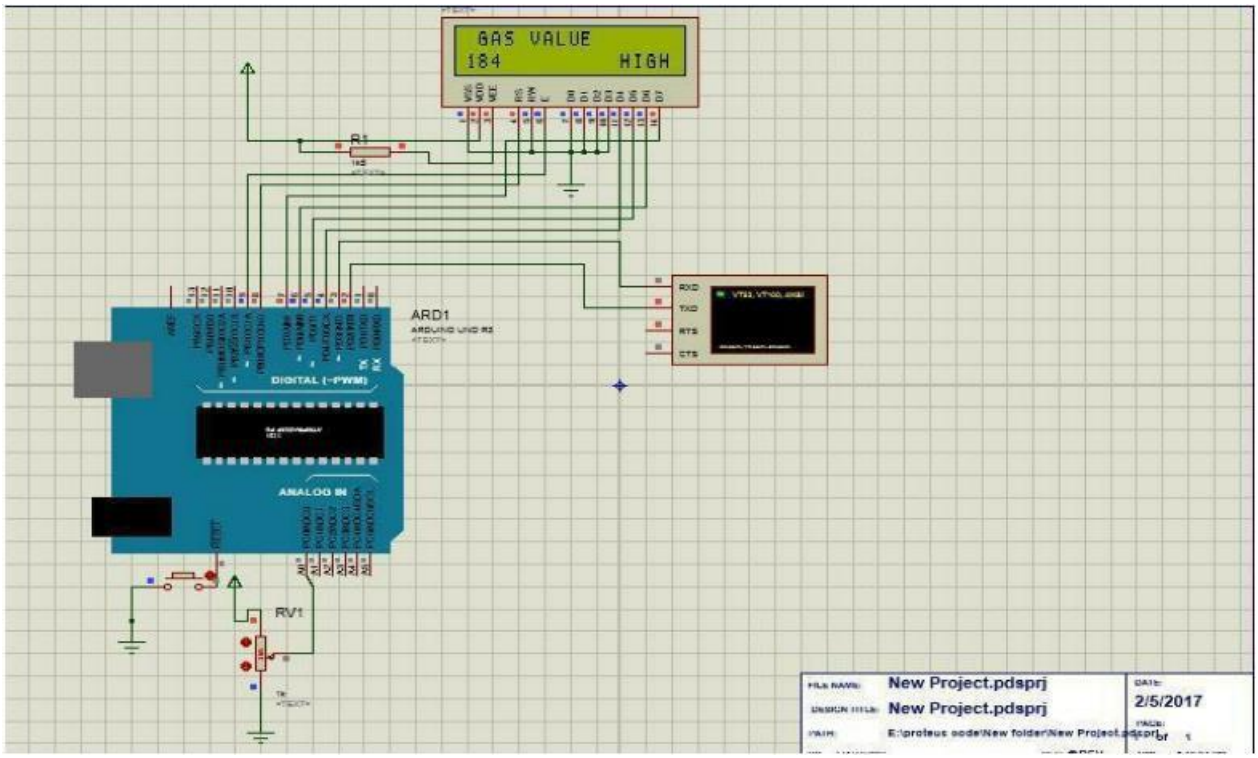
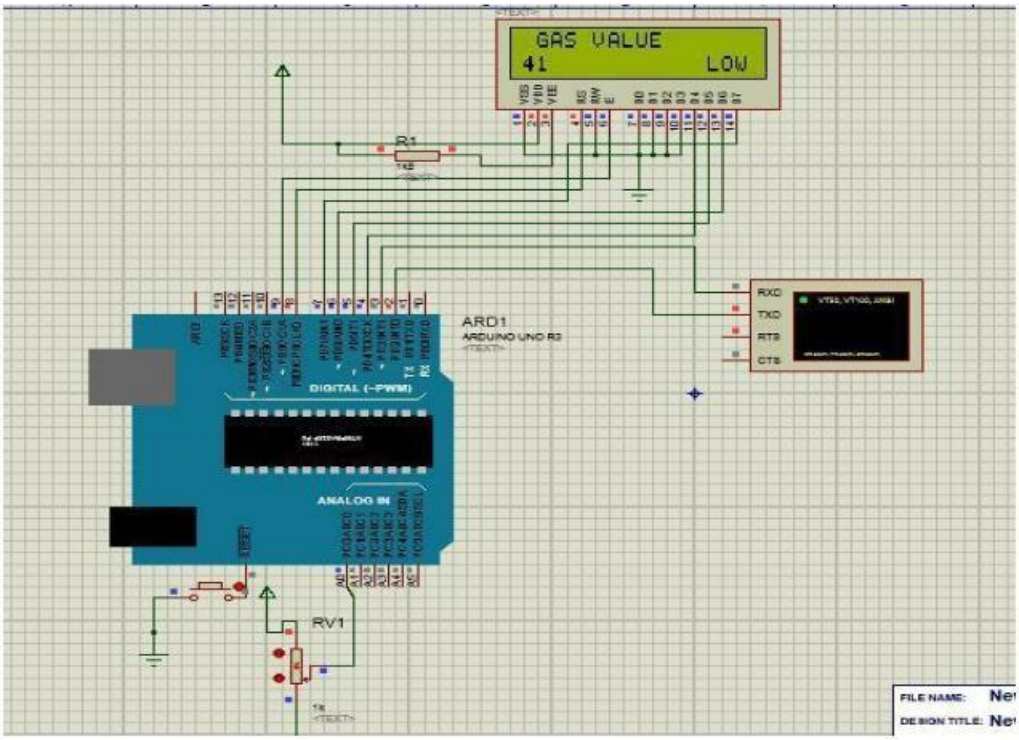


Fig 5.1circuit in Proteus is ready for usage

SOFTWARE RESULT



software result for high gas leakage



software result for low gas leakage

CONCLUSION

In this work a new approach for gas leakage detection system at a low concentration.
The leakage is detected with the help of MQ-2 gas sensor. Sensor sends a signal to microcontroller. In the next step microcontroller sends an active signal to other externally connected devices. A multiple SMS can be send by changing programming GSM module. **FUTURE WORK:**
Future Automatic fire suppression systems react to a rapid rise in heat, or fire situation, without any human intervention. These systems contain Detection element, such as pneumatic tubing or a smoke detector and Suppression agent cylinder for alerting and suppression of fires.
Machine to machine communication introduced for effective detection in a multi robot environment.

REFERENCES

L. Atzori, A. Iera, and G. Morabito. The internet of things: A survey.Computer networks, 54(15):2787–2805, 2010.
A. Biral, M. Centenaro, A. Zanella, L. Vangelista, and M. Zorzi. Thechallenges of m2m massive access in wireless cellular networks. DigitalCommunications and Networks, 1(1):1–19, 2015.
S. Dalola, S. Cerimovic, F. Kohl, R. Beigelbeck, J. Schalk, V. Ferrari,D. Marioli, F. Keplinger, and T. Sauter. Mems thermal flow sensor withsmart electronic interface circuit. IEEE Sensors Journal, 12(12):3318–3328, 2012.
R. Deng, Z. Yang, M.-Y. Chow, and J. Chen. A survey on demandresponse in smart grids: Mathematical models and approaches. IEEETransactions on Industrial Informatics, 11(3):570– 582, 2015.
S. Duan and S. Dong. Tnumerical study of the metering principle forthermal flow sensor based on micro electro mechanical system. ACTAMETROLOGICA SINICA, 37(6):623–627, 2016.