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ANTI-THEFT ALERTING AND MONITORING OF ANIMALS USING INTEGRATED GPS AND GPRS IN INDIAN SCENARIO

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ABSTRACT

Animals, particularly dairy animals have become part and parcel of rural Indian families. These animals provide fixed monthly income for a farmer, which helps famers to survive even in drought. These animals are not manually fed, they roam in nearby agriculture fields for grass and return to the homes in the evening. Since these animals have become costly (around one lakh rupees) there is always a threat of being stolen or the animals may miss the path to the home. Here an idea is presented to alert the farmer when the animals lost their path to home or when have been stolen. Here GPS and GPRS which are connected using ARM microcontroller is used. These devices are tied around the neck of the animal in the form of belt. Geo-fences, which specify the locations, where the animal can stay are fixed by the farmers. These fences can be nearby agriculture fields, farmer home etc. When the animal tries to leave these geo fences, or when the belt which is tied around the neck of the animal is tried to be removed forcibly an alert is send to the farmer in terms of a buzzer, SMS, or a telephone call. The geo-fences can be fixed based upon time, for e.g. during day time they can be nearby agriculture fields, and during night time it can be farmers home etc. Here an accuracy of 10 meters is achieved. The farmer can monitor the animals from home with this technology, and he need not keep an eye on these animals and can concentrate on other agriculture works. The entire system is developed at very low cost, and the operating cost is also very low since GPRS data is very low priced it will not cause any economic burden to the farmer. This technology can also be used for other pet animals such as dogs, cats etc. It can also be used to monitor the child who goes to school, or some other location.

Index Terms: Monitoring, GPS, GPRS, Geo-Fences.

I. INTRODUCTION

Animals have become an important part in human's life. Their safety and security of these creatures is very important. Thieves normally steal the animals during night time, as it is the time, they can do their job unnoticed. As the human also can't have vigilance over the animals 24/7, an idea of "anti-theft alerting and monitoring of animals using GPS and GPRS" is proposed here.

Nagothu, et al., (2014), In Rural India along with agriculture the farmer also feeds animals such as buffaloes or cows to get milk. It gives them additional income to their families. The income is instant they need not wait for the crop, which normally takes more than six months. Sometime the crop may get damaged by unseasonal rains etc. Because of this the number of farmer suicides is increasing in India day by day. Nagothu, et al., (2014) So farmers in India are concentrating on milking animals as an alternative. People in developing countries can't run dairy because of their financial constraints. Normally they will buy one or two animals which cost around 40000 INR per animal (Kumar and Nagothu 2016). These animals are self-fed; they will eat the grass in nearby fields and return back to homes by evening times (Rengarajan and Anitha, 2013). When these animals are stolen, the normal life of rural farmer will be disturbed. The farmer will lose all the investment made on these animals, more than the money the attachment with animals will hurt him most. The integrated GPS, GPRS system is used in many real time applications. In situations where GPS signal can't be reached inertial navigation system (INS) is used, whose error to be corrected with time.

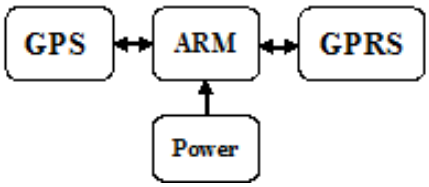

Figure 1. Block diagram of belt

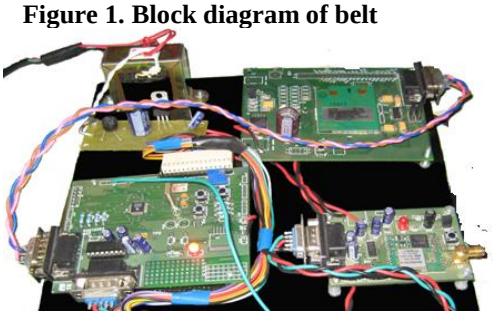

Figure 2. Proto type of belt surrounding the neck of animal

II. NAVIGATION AND GEO FENCING

Nagothu, (2016) presents GPS is used here to find the position of the animal using triangulation technique. There are 24 satellites revolving around the earth, which are used to find the position. These satellite system was built and maintained by the department of defense, America, which is available at free of cost (Rajaduraimanickam, et al., (2014). The GPRS (General Packet Radio Service) has its presence all over the world. The radio waves are used here in such a way that the same bandwidth can be shared by a large number of users. Normally the person who uses the GPRS will be charged based upon the amount of data he used, but not on the time he spent on the network. The amount charged is also very less, which is around 100 INR for one gigabyte second generation network data. The system discussed here requires 1 GB data, so the operating cost is very less.

A. *Geo-fences:* These are the areas that can be created by defining the coordinates of the four corners of the area using GPS (Ramalingam, et al., (2009). The animals are allowed to eat grass only in these areas. Once defined you can receive alert messages if the animal moves out of the boundary (Nagothu and Anitha, 2016). The geo-fence can be set based upon the time, i.e. during night time the area can be around 20 m radius from the farmer's house, whereas during a day time the area can be increased.

Figure 3 Animal with RFID (yellow color)

Animal Details

Animal RF ID	9502611438
AGE	5.5 years
Date of birth	11/4/2010
Bread	murrae
COW/ Buffalo	Buffalo

Figure 4. Animal details

III. PROPOSED METHOD

In village environment, dairy animals daily go to nearby fields to feed themselves. It is not a common practice to feed the animals in dairy farm. Nagothu, S.K., Anitha, G (2014) So monitoring of the animals and tracking them will be difficult in open fields. Since the animals are habituated to go to the fields and get fed. The owners of animals monitor them casually. In this situation the animals may go out of the villages, and even they may be illegally transported to other places by unknown people. Here we are proposing an Anti-theft alerting and monitoring of animals using integrated GPS and GPRS system. Here we are using GPS and GPRS, which are integrated using ARM microcontroller. These three devices are embedded in the form of the belt, which is tied over the neck of the animal. When some unauthorized person tries to remove the belt around the neck of the Animal an alert is sent to the owner. The block diagram and prototype are given in figure 1 and 2 respectively.

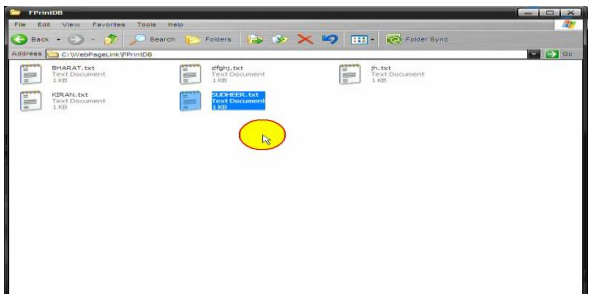

Figure 5 Saving the animal details in database

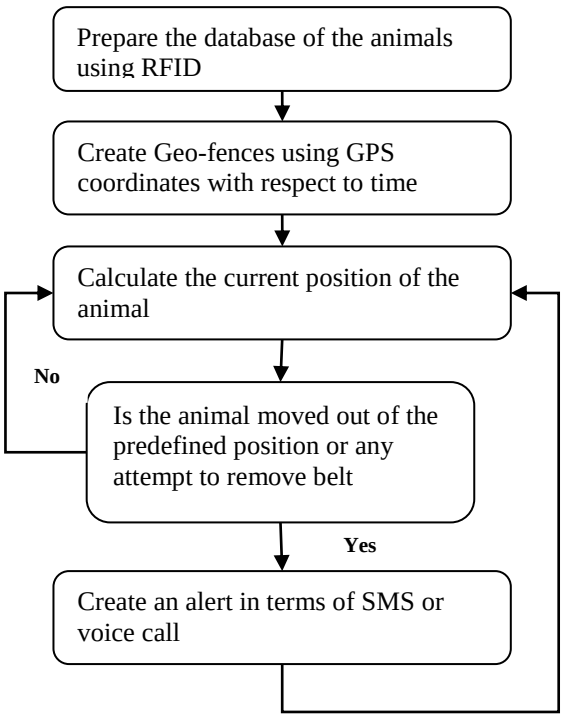

Figure 6 Flow Char

IV. DATA PROCESSING: If a person has a single animal the process is simple, but when he is having more than one problem arises (Nagothu and Anitha, 2015), So here RFIDs are used to fix this ambiguity of monitoring of more animals. Initially cattle are staples with RFIDs to the ears as shown in figure 3.

The RFIDs are used to uniquely identify the animals. Here using the RFIDs the database is prepared by entering the animal sex, date of birth, color, any other distant feature etc. as shown in figure 4. Nagothu and Anitha (2019) describe in details the data base can be created as shown in figure 5.

Flowchart for the sequence of operations is shown in figure 6. Initially animal database is prepared using RFID. When the animal moves out of the predefined position an alert will be sent to the farmer.

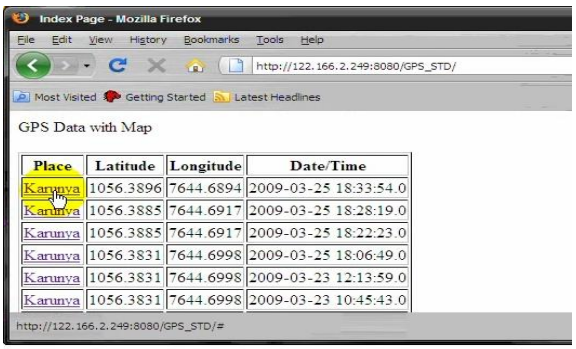

Figure 7 GPRS web server

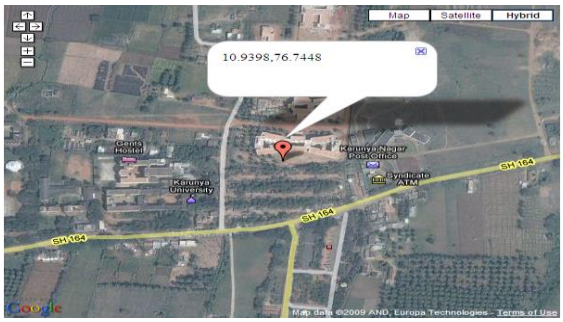

Figure 8 Animal location through Google earth

The person who owns the animals need to provide the area at which the animals can roam for feed. The latitude and longitude for the location corner can be saved into the memory provided at the belt surrounded to neck of the animals. Here we use flowing formulae to find the difference between the present position of the animal and pre-defined position.

$$a = \sin^2(\frac{\phi_2 - \phi_1}{2}) + \cos(\phi_2) * \cos(\phi_1) \sin^2(\frac{\lambda_2 - \lambda_1}{2})$$

$$d = 2 * R_E * a \tan 2(\frac{\sqrt{a}}{\sqrt{(1-a)}})$$

Where ϕ_1, λ_1 is latitude & longitude of present position, ϕ_2, λ_2 is latitude & longitude of pre-defined position and R_E is Earth's radius (approximately 6371000 meters), and all angles are in radians. Distance in meters is given by d.

When the animal leaves the prescribed position and an alert will be sent to the persons mobile. The range of d can be set based upon time. During the day time when normally the animals roam out for feed, it shall be around 900m and at night time it can be around 50 m with respect to the person's home.

When the belt tied to the neck of the animal is trying to be removed by an unauthorized person a message will be sent to the person or phone call can be made with the pre-stored voice from the GPRS module located in the belt. When the animal goes out to feed the present location of the animal is sent to the server through GPRS as shown in figure 7. With which the authorized person can track the animal on the Google earth maps as shown in figure 8.

CONCLUSION

An idea is proposed to monitor the animals using GPS and GPRS technology. Since Animals, especially dairy animals have played a very important role in the lives of rural Indian farmers from the sale of dairy products, when these animals are stolen it will disturb the life of the farmers. Using this technology the farmer can continuously track the animal, and when the animals leaves the predefined position either by unauthorized person or whether it misses the path to the home an alerts will be sent to the farmer. The rapid growth of mobile technology has made the farmer to comfortably sit at the home and monitor the animal in their mobiles using Google maps. Through this technology, we can bring smiles in farmers face.

REFERENCES:

Nagothu, S.K., Kumar, O.P., Anitha, G.: Autonomous monitoring and attendance system using inertial navigation system and GPRS in predefined locations. In: 2014 3rd International Conference on Eco-friendly Computing and Communication Systems, Mangalore, Pp. 261–265 (2014). https://doi.org/10.1109/eco-friendly.2014.60

Nagothu, S.K., Anitha, G., Annapantula, S.: Navigation aid for people (joggers and runners) in the unfamiliar urban environment using inertial navigation. In: 2014 Sixth International Conference on Advanced Computing (ICoAC), Chennai, pp. 216–219 (2014). https://doi.org/10.1109/icoac.2014.7229713

Nagothu, S.K., Kumar, O.P., Anitha, G.: GPS aided autonomous monitoring and attendance system. Procedia Comput. Sci. 87: 99–104 (2016).

Nagothu, S.K.: Weather based smart watering system using soil sensor and GSM. In: 2016 World Conference on Futuristic Trends in Research and Innovation for Social Welfare (Start-up Conclave), Coimbatore, Pp. 1–3 (2016). https://doi.org/10.1109/startup.2016.7583991

Rengarajan, M., Anitha, G.: Algorithm development and testing of low cost way point navigation system. Eng. Sci. Technol. Int. J. 3(2): 411–414 (2013)

Nagothu, S.K., Automated toll collection system using GPS and GPRS. In: 2016 International Conference on Communication and Signal Processing (ICCSP), Melmaruvathur, Tamilnadu, India, Pp. 0651–0653 (2016).

Rajaduraimanickam, K., Shanmugam, J., Anitha, G.: ADDR-GPS data fusion using Kalman filter algorithm. In: 24th Digital Avionics Systems Conference 2, volume 2 (2005) https://doi.org/10.1109/dasc.1563447

Ramalingam, R., Anitha, G., Shanmugam, J.: Micro-electromechnical systems inertial measurement unit error modelling and error analysis for low-cost strapdown inertial navigation system. Def. Sci. J. 59(6): 650–658 (2009)

Nagothu, S.K., Anitha, G.: INS—GPS integrated aid to partially vision impaired people using Doppler sensor. In: 2016 3rd International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, Pp. 1–4 (2016).

Nagothu, S.K., Anitha, G.: Low-cost smart watering system in multi-soil and multi-crop environment using GPS and GPRS. In: Proceedings of the First International Conference on Computational Intelligence and Informatics Volume 507 of the series Advances in Intelligent Systems and Computing, Pp 637–643 (2017). https://doi.org/10.1007/978-981-10-2471-9_61

Nagothu, S.K. Anitha, G.: INS-GPS enabled driving aid using Doppler sensor. In:2015 International Conference on Smart Sensors and Systems (IC-SSS), Bangalore, pp. 1–4 (2015).

Nagothu S.K., Anitha G., Automatic Landing Site Detect-ion for UAV Using Supervised Classification. In: Rao P., Rao K., Kubo S. (eds) Proceedings of International Conference on Remote Sensing for Disaster Management. Springer Series in Geomechanics and Geo-engineering. Springer, Cham https://doi.org/ 10.1007/978 -3-319-77276-9_27 (2019)