JOURNAL FOR INNOVATIVE DEVELOPMENT IN PHARMACEUTICAL AND TECHNICAL SCIENCE

Volume-2,Issue-8 (Aug-2019)
ISSN (O) :- 2581-6934

BORE-WELL DETECTION USING MICROWAVE RADAR AND SONAR

Aksa David[1], Linu Babu P[2]

[1,2]Assistant Professor,

[1,2]Department of Electronics and Communication Engineering, IES College of Engineering, Chitillapilly, Thrissur, Kerala

Abstract— Now a days we are facing a distressed cruel situation like a child has fallen in bore-well and struck in the hole which is uncovered and getting trapped. Rescue of the trapped child from bore-well is a very risky and difficult process. All are busy thinking about how to save a trapped child from bore-well. But there are no steps taken to prevent the child from falling into the bore-well. Here, in this paper, a step is taken to avoid children from falling into the bore-well. A robotic device is proposed. There is an arm-like structure on the top of the device which is extended horizontally towards the front of the device. At the tip of the arm, a curved structure is attached. On that, sonar is mounted. When the device is moved through a field or land, sonar emits radiation which will reflect when a strike on the ground. When sonar waves take more time than a fixed threshold to come back to the device, it is assumed that there is a pit or bore well. The device is controlled by an Arduino controller. A GSM module is attached for the wireless communication between the devices and monitors.

Index Terms—bore well, Arduino, Microwave Radar, and Sonar

INTRODUCTION

A bore well is a deep, narrow hole drilled into the ground from which water is drawn through a pipe and pump. Bore-wells are typically small in diameter — ranging from 4.5 inches (low-capacity bore-well) to 12 inches (high-capacity bore-well). Bore-wells tap into water-bearing soil or rock layers called aquifers and can go as deep as 1,500 feet into the ground. Bore-well technology was first introduced in India in the 1970s as a measure to counter water scarcity. India now has approximately 27 million bore-wells, but several of them have been abandoned because they no longer supply water. When a bore-well dries up and is no longer in use, its cover, usually made of cast iron, is removed and the PVC pipe pulled out, leaving behind a naked hole. The pipe and the iron cast are removed to show that the well is no longer useful. Since water is a state subject, there exists no national-level database of abandoned bore-wells. States such as Kerala have begun tracking the number of bores- wells constructed and those abandoned, but other states are yet to follow as diligently. In June this year, 2-year-old Fate veer Singh from Bhagwanpura, Punjab, died when he fell over 100 feet into an open bore-well. In May, 4-year-old Seema from Jodhpur, Rajasthan, met with a similar fate. The NDRF data suggests the deadly combination of uncovered, abandoned bore-wells and children playing around them are the biggest cause of such fatal accidents. Other reasons include flimsy covering of bore-wells and a lack of warning signs. “When a child falls in, they fall into a pit from which a pipe has been removed, so the walls of the bore-well are not smooth, but rugged. Even if you want to pull the child out, there is hardly any space to do so, and the type of soil surrounding the pit could lead to collapse," said an official of Central Ground Water Board (CGWB), who didn't want to be named. Rescue operations depend on several factors — the type of soil, the diameter of the bore well, and the depth at which the victim is stuck. Since surfaces beneath the ground vary across states and regions, standardizing equipment and methods of rescue is impossible. In places like Rajasthan and Haryana, soil tends to be loose and sandy, making it more susceptible to collapse. In hillier regions, where the soil is rocky, drilling requires heavy machinery and is much harder to do. The rescue team has to

keep this in mind when going about the operation, Krishna Kumar, assistant commandant of the NDRF, told The Print. Kumar said when the victims are children, the rescue operation gets harder because they are very young and don't listen to instructions properly when scared and stressed. The space to maneuver within a bore-well is also very less, making it difficult to pull out victims. The most popular method of rescue is to drill a parallel hole and then move horizontally until the path reaches the victim.

LITERATURE SURVEY

Feroz Morab et al [1] the paper is an effort that has been put to cater to the needs of land surveys. Here, a robot is developed to conduct the land survey, specifically to calculate the area of a given land and to divide it into subplots. The process involves two parts- Survey Robot and area measurement module. The Survey Robot is controlled through the Zig Bee module to move about the entire plot. The distance traveled by the Survey Robot is calculated by timer concept and this value is then transmitted to the PC. The second part involves the area measurement module designed using Embedded C allowing the user to efficiently determine the area of the plot. The Survey Robot so designed specializes in area measurement for commercialized plots. This implies that the Survey robot would perhaps become a boon for those who are involved in large property dealings across metropolitan cities. Since time immemorial, for measuring the area of a regular size plot or any other plot, more manpower is required. This is because; various tools are involved in this process such as measuring tape, rulers, etc. So at least a minimum of two people has to stand end-to-end to measure each side of the plot. This measured value is then recorded by a third person who does the required conversion. And then the area of that particular plot is obtained. Hence the present surveying or area measurement techniques are tedious and tiring. On the other hand, the major advantage of a survey robot is that manpower required and equipment used is less. The time consumed for area measurement is considerably less compared to the conventional technique and it has better accuracy making reprogramming easier. Also, robots have now become a major part of today's technological advancements. Hence we have designed and implemented a robot that can solve this disadvantage of the present surveying technique and reduce manual labor. Being a new concept, it has a great scope for improvement. K. Chidambaram et al [2] this paper is the idea of us to make the land survey by using a robot using the updated technology known as Arduino Uno. Here, we have made a robot to survey the land. It is made especially for making the area calculation of the given land. The survey robot is entirely controlled by using a Bluetooth module to move the robot to the entire land for the survey. The total distance traveled in the land is calculated by using the timer concept, and then they obtained values are transmitted to an LCD screen. The second process involves an area measurement module using Arduino / Genuino UNO software allowing the user to determine the area of the land given for surveying. The Land Survey using a Robot is an effort being put to cater to the needs of a land survey, in particular, area measurement. Here a robot is being used for area measurement. Surveying or land surveying is the science and technique of accurately determining the terrestrial or three-dimensional position of points, distances, and angles between them. To accomplish their objective, surveyors use elements of mathematics (which includes geometry and trigonometry), physics, engineering, and law. Also, a wide range of surveying equipment is used for this purpose. Initially, the required materials and equipment are taken then the design layout of the chassis is made to eradicate the accuracy of the measurement by the robot. Hence required program is created by using Arduino UNO software and then the created code is then transmitted to the Arduino Uno board. The motor driver is connected to the Arduino followed by the respective pins given in the program for Arduino Uno as per the program the 100 rpm motors are connected at either side of the chassis. Then the Bluetooth module is connected with the Arduino to receive the signals for the movement of the robot from the mobile similarly the roller ball is inserted at the front of the chassis. The hence ultrasonic sensor is placed at the top of the chassis to get the estimated accurate reading is going to be measured by the plotting values of the given land. The value measured by the robot will be displayed in the given LCD screen connected along with the Arduino Uno board. Then the photodiode and infrared sensor are inserted at either side of the chassis to detect the obstacle that reaches the robot. For controlling the robot we have generated the app to control the

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movement of the robot directions such as forward, backward, left, right, etc., and also the land mapping diagram is received through the Bluetooth module to the laptop. Li Lieut al [3]. Underground void detection is important due to its effects on subsidence higher risk. Ground-penetrating radar (GPR) is a non-destructive geophysical electromagnetic method and has been widely used in underground void detection or cavities locator. However, because of heavy clutter conditions, the void response is usually obscured. In this paper, imaging followed-removal algorithm based on low-rank and sparse representation is presented to suppress the clutter and obtain the void geometrical properties. The proposed algorithm firstly focuses on the sparsity of the raw data using the Frequency-Wave number migration imaging method and then removes the clutter by the robust principal component analysis (RPCA) method. Simulation results of the air-filled void, air-water-filled void, and void with pipeline in its sideshow that our proposed algorithm can remove the clutter efficiently and then the void information can be easily obtained, which is beneficial to further identification. In this paper, an improved clutter removal algorithm, called the imaging-followed-removal algorithm is proposed to facilitate void detection. The algorithm firstly strengthens the target response by the F-K migration imaging method, and then removals the clutter by RPCA. Therefore, the target features can be extracted in the sparse component. Simulation results show that it can effectively suppress the clutter and obtain the void geometrical information, which is beneficial to further identification. Unfortunately, limited to the experimental equipment, real experiments are not conducted, which will complement in the future. Nachappa Gopalsami et al. [4]. This report describes the development of a microwave (MW) radar sensing and imaging system to remotely detect and locate gas leaks in natural gas pipelines. It contains theoretical and experimental results to show the feasibility of the radar technique. The gas dynamics of the leak jet are modeled first to determine the plume geometry and the variation of gas concentration in the air with distance from the leak source. From the turbulence-induced static and dynamic changes of the index of refraction, the radar backscatter cross-section of the plume is determined next. To verify the model predictions and to determine the detection sensitivity of gas leaks, a commercial X-band radar system was interfaced with a computer to enable data collection and specialized signal and image processing. The radar, calibrated with a corner cube, was tested on gas plumes (cold nitrogen for initial test and propane leak for long-range test). The radar cross-sections of gas plumes, calculated from the test data, were in the general range of the model predictions. The results thus indicate the technical feasibility of the radar technique for remote and fast inspection of gas pipelines for leaks. Chong Yang Wei et al. [5]. The current state-of-the-art in Autonomous Ground Vehicle (AGV) technology requires expensive, delicate laser range finders to apperceive the environmental impact of driving. The situation of too costly later represents a large barrier to adoption of AGV in the future, whereas provides an opportunity for close-to-market large range sonar sensor. In this paper, we propose an obstacle detection algorithm using adjacent periods' echo data of the large range sonar sensor in the off-road environment. We first integrate vehicle odometry into the sonar sensor and succeed in changing one dimension (1D) distance information into a two-dimension (2D) signal, which provides a strong prior constraint to filter unstable noisy echoes. We use the Hungarian algorithm to solve the correspondence of data points to make sure they are reflected by a mutual object. Matched dual points are used to extract the obstacle's line feature represented in the manner of the common tangent of the two intersecting arcs. Experiments in the outdoor environment demonstrate the validity of our algorithm. In this paper, we proposed an obstacle detection algorithm with a large range sonar sensor in the off-road environment. Odometry information of vehicle was integrated into the sonar sensor and built a novel 2D model, which provided strong prior constraint to filter noise. We used the Hungarian algorithm to solve the correspondence of sonar points to make sure they were from a mutual obstacle. Matched dual points were used to extract the obstacle' line feature represented in the manner of the common tangent of the two intersecting arcs. Experiments in the outdoor environment demonstrated our algorithm. Nguyen Thi Phuoc Van et al. [6]. This paper presents a survey of recent developments using the Doppler radar sensor in searching and locating an alive person under debris or behind a wall. Locating a human and detecting vital signs such as

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breathing rate and heartbeat using a microwave sensor is a non-invasive technique. Recently, many hardware structures, signal processing approaches, and integrated systems have been introduced by researchers in this field. The purpose is to enhance the accuracy of vital signs' detection and location detection and reduce energy consumption. This work concentrates on the representative research on sensing systems that can find alive people under rubble when an earthquake or other disasters occur. In this paper, various operating principles and system architectures for finding survivors using microwave radar sensors are reviewed. A comparison between these systems is also discussed. In this paper, some representative microwave Doppler sensor systems for finding survivors were discussed. For this special purpose, most of the considered systems operated at the S and L frequency bands. The power of the radar systems for this application was also much higher than the systems used for medical applications. Moreover, the signal processing techniques were very important to remove noise and clutter to improve the accuracy of the radar sensor systems.

PROPOSED SYSTEM

A method for preventing risk situations related to the bore well environment has been proposed. India is facing a distressed cruel situation where in the previous year's some child deaths have been reported falling in the bore-well. As the diameter of the bore well is quite narrow for any adult person and the lights go dark inside it, the rescue task in those situations is a challenging task. Here we are proposing a robotic system that will detect the uncovered, abandoned, and flimsy covered bore-wells. Our proposed system consists of mainly a robotic vehicle in which an arm-like structure is attached on the top of the vehicle which is extended up to 1 foot towards the front of the vehicle. At the free end of the arm structure, a microwave sensor module and a sonar module are attached.

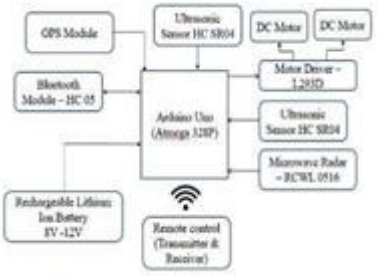

Fig 1 Block Diagram of Entire System

The block diagram explains the principal parts or functions of the system. The microcontroller used is ATMEGA328P. It is an 8bit microcontroller. Other main components used are GPS, GSM, ultrasonic sensor, MWR sensor, etc. We use a mobile phone as a control section.

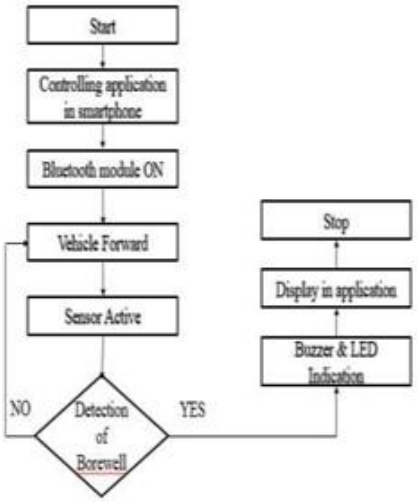

Fig 2 Flow Chart of Entire System

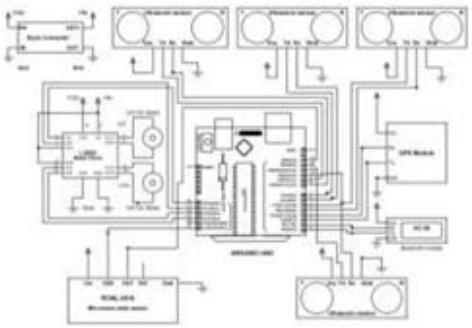

Fig 3 Circuit Diagram of Entire System

IV SOFTWARE STUDY

EMBEDDED C

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. Embedded C uses most of the syntax and semantics of standard C. In Embedded applications there is a need to

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read/write data on a given address, and in C it is easy to access and modify addresses, because of the pointers which are a language feature. The C programming language is perhaps the most popular programming language for programming embedded systems. C remains a very popular language for micro-controller developers due to the coding efficiency and reduced overhead and development time. C offers low-level control and is considered more readable than assembly. Many free C compilers are available for a wide variety of development platforms. The compilers are part of IDEs with ICD support, breakpoints, single-stepping, and an assembly window. The performance of C compilers has improved considerably in recent years, and they are claimed to be more or less as good as assembly, depending on who you ask. Most tools now offer options for customizing the compiler optimization. Additionally, using C increases portability, since C code can be compiled for different types of processors.

PROTEUS DESIGN SUITE

The Proteus Design Suite is an Electronic Design Automation (EDA) tool including schematic capture, simulation, and PCB Layout modules. It is developed in Yorkshire, England by Labcenter Electronics Ltd with offices in North America and several overseas sales channels. The software runs on the Windows operating system and is available in English, French, Spanish and Chinese languages. The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design. It can be purchased in many configurations, depending on the size of the designs being produced and the requirements for microcontroller simulation. All PCB Design products include an auto router and basic mixed-mode SPICE simulation capabilities.

Fig 4 User interface view of Proteus design suite

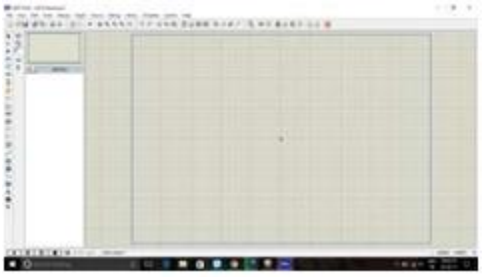

Fig 5 Terminal view of proteus

Schematic capture in the Proteus Design Suite is used for both the simulation of designs and as the design phase of a PCB layout project. It is therefore a core component and is included with all product configurations. The microcontroller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables it's used in a broad spectrum of project prototyping in areas such as motor control, temperature control, and user interfaces design. It also finds use in the general hobbyist community and, since no hardware is required, is convenient to use as training or teaching tool. The PCB Layout module is automatically given connectivity information in the form of a netlist from the schematic capture module. It applies this information, together with the user-specified design rules and various design automation tools, to assist with error-free board design. Design Rule Checking does not include high-speed design constraints. PCBs of up to 16 copper layers can be produced with design size limited by

CONCLUSION

A robotic vehicle for the early detection of uncovered, abandoned and flimsy covered bore-wells is proposed. Microwave radar is used to detect flimsy covered bore-wells. Sonar is used for uncovered bore-wells. The wave nature of microwave radar in different mediums determines the presence of flimsy covered bore-wells. Early detection of such bore-wells helps to prevent fatal accidents. The vehicle moves over the ground, and at the same time, it emits sonar and microwave radar waves to the ground through a transmitter and receives the signal back using receiver placed on it and using the received data and statics we are finding out the bore-wells.

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