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WIRELESS SENSOR NETWORK BASED SMART HOME SYSTEM WITH SERVICE ROBOT

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ABSTRACT
This paper is concerned with constructing a prototype intelligent home environment for home service robot. In this environment, multi-pattern information can be represented by some intelligent artificial marks. Light-packs service robots can provide reliable and intelligent service by interacting with the environment through the wireless sensor networks. The intelligent space consists the following main components: smart devices with intelligent artificial mark; home server that connects the smart device and maintains the information through wireless sensor network; and the service robot that perform tasks in collaboration with the environment. In this paper, the multi-pattern information model is built, the construction of wireless sensor networks is presented, and the smart and agilely home service is introduced. Finally, the future direction of intelligent space system is discussed.
KEYWORDS: Wireless Sensor Network, Robot, GPRS, Zigbee

INTRODUCTION
Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labour to turn valves ON and OFF. In addition, farmers using automation equipment are able to reduce run off from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. Automatic Drip Irrigation is a valuable tool for accurate soil moisture control in highly specialized production and it is a simple, precise method for irrigation. It also helps in time saving, removal of human error in adjusting available soil moisture levels and to maximize their net profits. The entire automation work can be divided in two sections, the field station and central station. Temperature sensors that are currently being used are linear with temperature, 0.05 $mV/^0C$ scale factor, with 0.5 ^0C accuracy guarantee able (at +25 ^0C). Low cost is assured by trimming and calibration at the wafer level. It works on the principal of conductance of electricity. When two electrodes A and B are inserted in soil and current is passed, the resistance to the flow of electricity is proportional to the moisture content in the medium.As the moisture level increases, conductivity decreases and the sensor is calibrated to output the moisture level. Since the probes have direct contact with the soil, there is no buffer against salt and fertilizer affects on the measured conductivity. The current work aims to develop a Wireless Sensor Network based low cost soil temperature and moisture monitoring system that

can track the soil temperature and moisture of the field in real time and thereby allow water to be dripped on to the field if the soil temperature goes above and/or the soil moisture falls below a prescribed limit depending on the nature of crop grown in the soil. The sensors take the inputs like moisture, temperature and provide these inputs to the microcontroller. The microcontroller converts these inputs into its desired form with the program that is running on it and gives outputs in the mode of regulation of water flow according to the present input conditions. The complete system is implemented for Smart Irrigation Application

SYSTEM DEVELOPMENT

WIRELESS SENSOR NETWORK TO CREATE A SMART SYSTEM:

WSN consists of two nodes i.e. Master node and Slave node.WSN used for communication purpose. So various sensor nodes placed in home system. Home section is divided in two sections: Room Section and Pick and Place Robot Section as shown in figure 1 & 2 respectively. Master nodes means Room section and Slave nodes means Pick and place robot section. In Room section various sensors are implemented such as Temperature sensor, LDR sensor, Humidity sensor, Gas sensor. Zigbee Transmitter connected in Room section. All sensor values are indicated on display but when critical condition arises particular action will takes place. When Temperature value increases above threshold value then buzzer will alarm simultaneously display "HIGH TEMPERATURE" and Fan is ON till temperature will slow down. When gas is detected buzzer will alarm and display "smoke detected" on LCD Display.LDR sensor indicates normal value but when threshold voltage increases light will be on and display sensor value. Humidity sensor indicates normal value but when humidity increases buzzer will alarm and display sensor value. All this data posted to web page through GPRS server. Slave node means pick ad place robot section, in this section Zigbee receiver is connected. In this section robot is used as picking and placing purpose. Robot will perform various actions like left, right, up, down, open, close, front, back and stop. RF wireless camera mounted on robot section for live video monitoring through PC or Laptop.

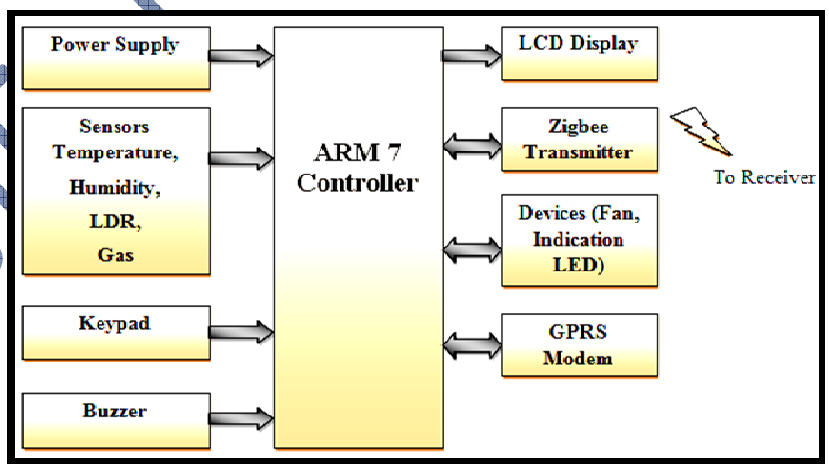


Fig 1: Block diagram of Room Section

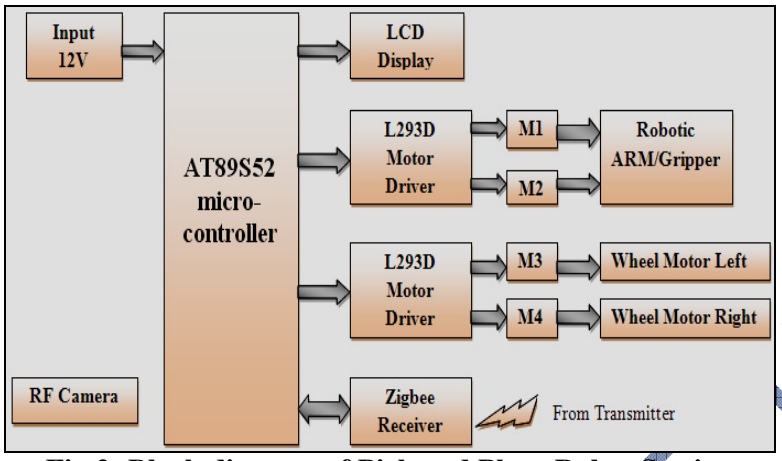


Fig 2: Block diagram of Pick and Place Robot Section

HARDWARE

3.1 ARM 7 (LPC 2148)

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

3.2 RF CAMERA

A surveillance camera is a video camera that is used to remotely monitor on an area or building by transmitting recorded images to a central control room. The area is observed using Surveillance cameras/ video cameras. Generally the output of surveillance camera/video camera is monitored by human such as security guard or law enforcement officer as it is connected to IP network or recorded device. This human monitoring leads to several limitations. The proposed system overcomes those limitations to some extends.

Wireless camera working (small mini wireless camera is connecting for transceiver and joint red, yellow cables and power supply cable connecting. The camera for connecting the personal computer for one chip for the driver is there and audio, video receiver and connects the antenna beside the tune is there and next side connect the power supply

and two cable pin, audio, video. The run the software and audio, video, image vehicle entry and exit capturing the image.

3.3 ZIGBEE

Zigbee is a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is based on an IEEE 802.15 standard. Though its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics, ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys.) ZigBee has a defined rate of 250 Kbit/s, best suited for intermittent data transmissions from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate

IMPLEMENTATION RESULTS

In Fig 3 and Fig.4 the hardware developed has been shown. It contains an Master Section and on the remote end a slave node with robotic platform with arm are designed. Such that the user can control and monitor the situation over web using GPRS can be viewed in Fig.5 and the live video monitoring using RF Camera.

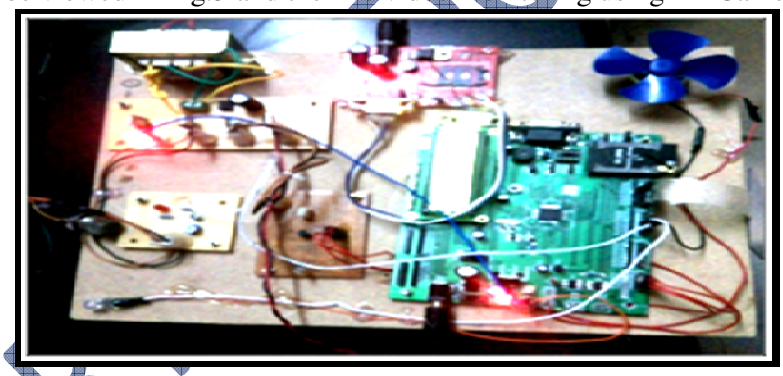


Fig 3: Master Node

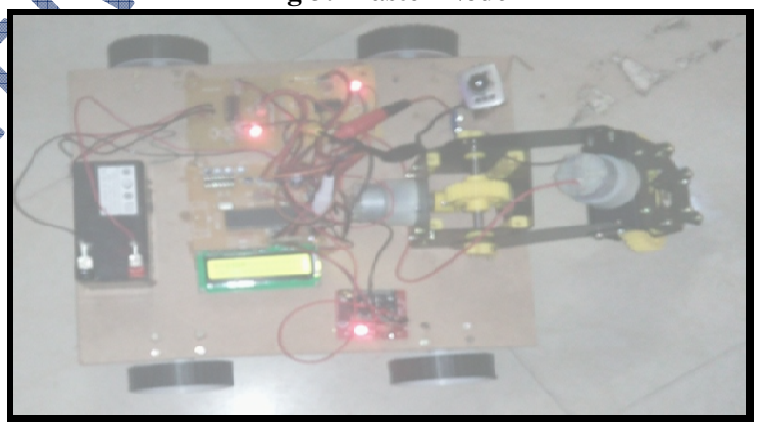
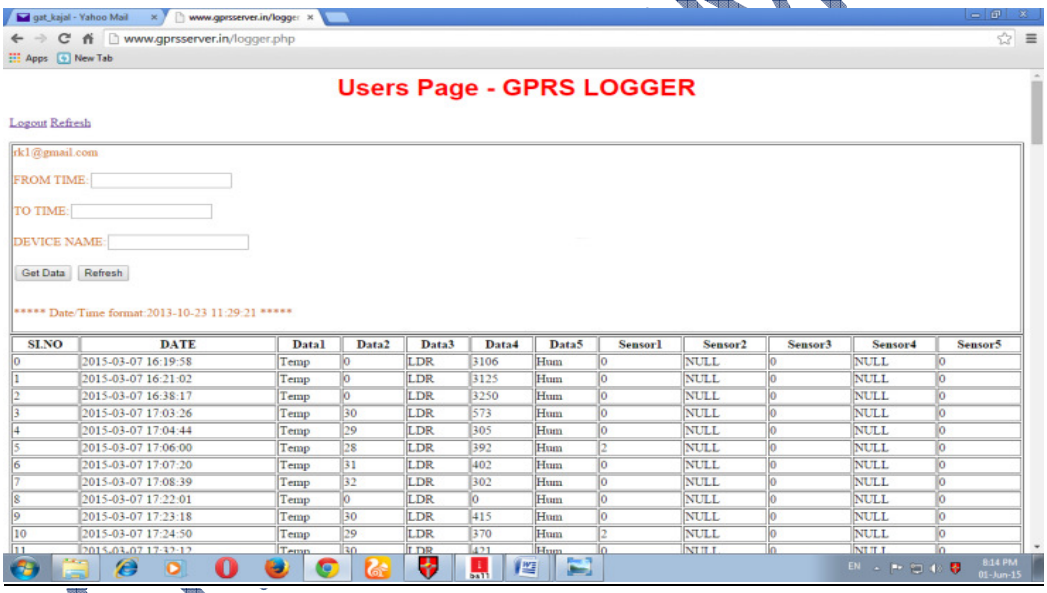


Fig 4: Slave Node

General Packet Radio Services (GPRS) is a packet-based wireless communication service that promises data rates from 56 up to 114 Kbps and continuous connection to the Internet for mobile phone and computer users. The higher data rates allow users to take part in video conferences and interact with multimedia Web sites and similar applications using mobile handheld devices as well as notebook computers. GPRS is based on Global System for Mobile (GSM) communication and complements existing services such circuit-switched cellular phone connections and the Short Message Service (SMS).

GPRS is a best-effort service, implying variable throughput and latency that depend on the number of other users sharing the service concurrently, as opposed to circuit switching, where a certain quality of service (QoS) is guaranteed during the connection. In 2G systems, GPRS provides data rates of 56–114 kbit/second.[3] 2G cellular technology combined with GPRS is sometimes described as *2.5G*, that is, a technology between the second (2G) and third (3G) generations of mobile telephony.[4] It provides moderate-speed data transfer, by using unused time division multiple access (TDMA) channels



SLNO	DATE	Data1	Data2	Data3	Data4	Data5	Sensor1	Sensor2	Sensor3	Sensor4	Sensor5
0	2015-03-07 16:19:58	Temp	0	LDR	3106	Hum	0	NULL	0	NULL	0
1	2015-03-07 16:21:02	Temp	0	LDR	3125	Hum	0	NULL	0	NULL	0
2	2015-03-07 16:38:17	Temp	0	LDR	3250	Hum	0	NULL	0	NULL	0
3	2015-03-07 17:03:26	Temp	30	LDR	573	Hum	0	NULL	0	NULL	0
4	2015-03-07 17:04:44	Temp	29	LDR	305	Hum	0	NULL	0	NULL	0
5	2015-03-07 17:06:00	Temp	28	LDR	392	Hum	2	NULL	0	NULL	0
6	2015-03-07 17:07:20	Temp	31	LDR	402	Hum	0	NULL	0	NULL	0
7	2015-03-07 17:08:39	Temp	32	LDR	302	Hum	0	NULL	0	NULL	0
8	2015-03-07 17:22:01	Temp	0	LDR	0	Hum	0	NULL	0	NULL	0
9	2015-03-07 17:23:18	Temp	30	LDR	415	Hum	0	NULL	0	NULL	0
10	2015-03-07 17:24:50	Temp	29	LDR	370	Hum	2	NULL	0	NULL	0
11	2015-03-07 17:32:12	Temp	30	LDR	421	Hum	0	NULL	0	NULL	0

Fig 5: GPRS Web Page

CONCLUSION

Wireless Sensor Networks and Internet of things-based smart home is becoming an important ambient-assisted living environment for individuals, where necessary care can be provided at the time of need, and wellness can be measured and predicted. The built system will convert and normal place into a smart home with the help of sensing technology designed. The expertise and knowledge of smarthome have been explored to extend it to an intelligent building. ISM band interference and attenuation issues have been considered to observe the effectivenessof wireless communication and placement of wireless nodes. More results will be reported in our future works.

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