

DESIGN OF REMOTE MONITORING AND CONTROL SYSTEM OF AUTOMATIC IRRIGATION SYSTEM USING GSM MODULE AND LINUX OS

¹SONALI M. BHISE, ²S.R.GAGARE

Amrutvahini College of Engineering, Sangamner
E-mail: ¹bhisesonali26@gmail.com, ²sunilgagare@yahoo.co.in

Abstract - Irrigated agriculture is one of the primary water consumers in most parts of the world. With developments in technology, efforts are being channelled into automation of irrigation systems to facilitate remote control of the irrigation system and optimize crop production and cost effectiveness. This project describes an on-going work on GSM based irrigation monitoring and control systems. The objective of the work is to provide an approach that helps farmers to easily access, manage and regulate their irrigation systems for the water needs of crops using SMS technology for data transportation. On different cellular networks revealed an average response time of 16 seconds from the time of SMS request to the controller system to read data or activate the irrigation system through data processing and submission to user. The GSM based irrigation system may offer users the flexibility to regulate and control the operations of their irrigation systems with little intervention to reduce runoff from over watering for improvement in crop yield.

Index terms - Linux, BeagleBone, GSM, DAS, Irrigation

I. INTRODUCTION

Irrigated agriculture is one of the primary water consumers in most parts of the world.

With developments in technology, efforts are being channelled into automation of irrigation systems to facilitate remote control of the irrigation system and optimize crop production and cost effectiveness.

This project describes an on-going work on GSM based irrigation monitoring and control systems.

The objective of the work is to provide an approach that helps farmers to easily access, manage and regulate their irrigation systems for the water needs of crops using SMS technology for data transportation.

II. OBJECTIVE

The prime objectives of new wireless generation agriculture system are:

- **Remote monitoring**
Data from sensors (soil moisture)
- **Remote control**
Switch Motor ON/OFF
- Study of Embedded Linux architecture.
- Understanding of the GSM Interface with Beagle bone.
- Use of the open source code in the agriculture application.
- Reduce the cost of the agriculture devices using the royalty free softwares.
- Understanding of Data Acquisition system.
- Run agriculture application on the Linux platform.
- To control agricultural motor through Short Message Service.
- To eliminate the need of being physically present in any location for tasks.

- Minimize the power and time wastage

III. DRIVER CIRCUIT FOR FAN:

Digital systems and microcontroller pins lack sufficient current to drive the circuits like relays, buzzer circuits, DC fans etc. While these circuits require around 10milli amps to be operated, the microcontroller's pin can provide a maximum of 1-2milli amps current. For this reason, a driver such as a power transistor is placed in between the microcontroller the device.

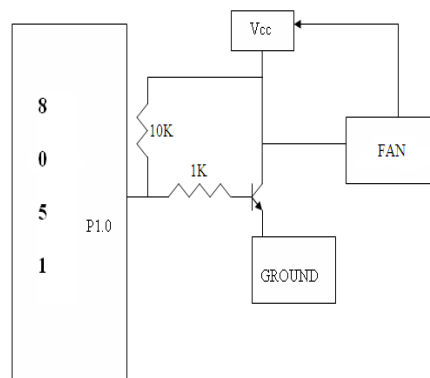


Fig 1:Driver Circuit for Fan

The operation of this circuit is as follows:

The input to the base of the transistor is applied from the microcontroller port pin P1.0. The transistor will be switched on when the base to emitter voltage is greater than 0.7V (cut-in voltage). Thus when the voltage applied to the pin P1.0 is high i.e., P1.0=1 (>0.7V), the transistor will be switched on and thus the fan will be ON.

When the voltage at the pin P1.0 is low i.e., P1.0=0 (<0.7V) the transistor will be in off state and the fan

will be OFF. Thus the transistor acts like a current driver to operate the fan accordingly.

Fan interfacing with the Microcontroller:

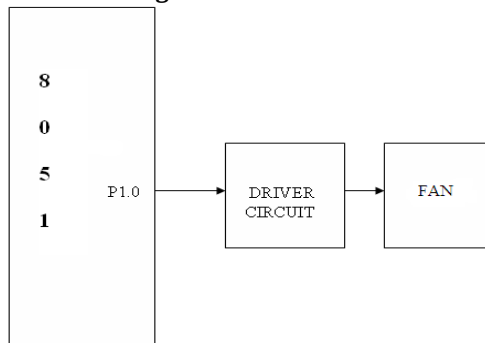
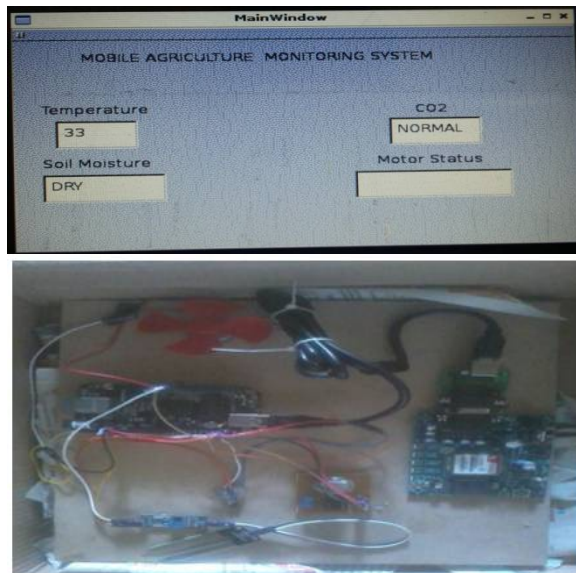


Fig 2 : Fan Interfacing with microcontroller

IV. SIMULATION/ EXPERIMENTAL SET UP



V. METHODOLOGY

- GPIO Interface
- USB-UART Interface
- Embedded Linux

VI. BEAGLE BONE BLACK SYSTEM:-

The **Beagle Board** is a low-power open-source hardware single-board computer produced by Texas Instruments in association with Digi-Key and Newark element14. The Beagle Board was also designed with open source software development in mind, and as a way of demonstrating the Texas Instrument's OMAP3530 system-on-a-chip.

The board was developed by a small team of engineers as an educational board that could be used in colleges around the world to teach open source hardware and software capabilities. It is also sold to the public under the Creative Commons share-

like license. The board was designed using Cadence or CAD for schematics and Cadence Allegro for PCB manufacturing; no simulation software was used

VII. TETHERED TO A PC

In this configuration, the board is powered by the PC via the provided USB cable—no other cables are required. The board is accessed either as a USB storage drive or via the browser on the PC. You need to use either Firefox or Chrome on the PC, IEx will not work properly. **Figure 3.** shows this configuration.

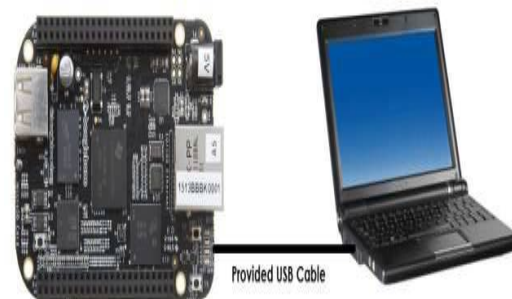


Figure 3. Tethered Configuration

All the power for the board is provided by the PC via the USB cable. In some instances, the PC may not be able to supply sufficient power for the board. In that case, an external 5VDC power supply can be used, but this should rarely be necessary.

VIII. Key Components

Figure 4 below shows the locations of the key components on the PCB layout of the board.

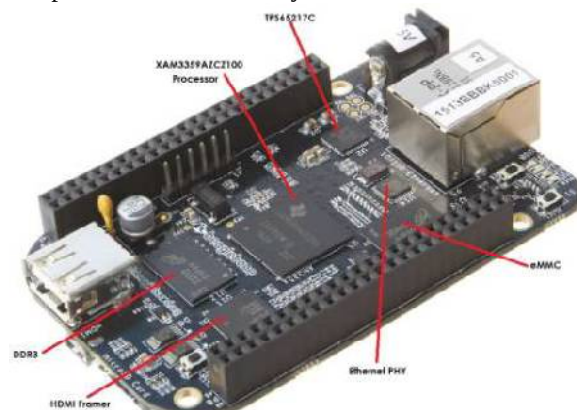


Figure 4. Key Components

- **Sitara AM3359AZCZ100** is the processor for the board.
- **Micron 512MB DDR3L** is the Dual Data Rate RAM memory.
- **TPS65217C PMIC** provides the power rails to the various components on the board.

- **SMSC Ethernet PHY** is the physical interface to the network.
- **Micron eMMC** is an onboard MMC chip that holds up to 2GB of data.
- **HDMI Framer** provides control for an HDMI or DVI-D display with an adapter

IX. BEAGLEBONE BLACK HIGH LEVEL SPECIFICATION

This section provides the high level specification of the BeagleBone Black. Block Diagram

Figure c below is the high level block diagram of the BeagleBone

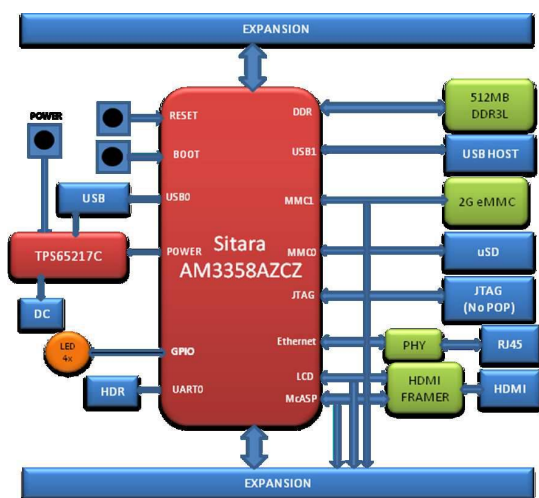


Fig 5. BeagleBone Black High Level Specification

SUMMARY

The extensive capabilities of this system are what make it so interesting. From the convenience of a simple cell phone, a farmer is able to control and monitor the motor in the agricultural field virtually from any distance. This makes it possible for the farmers to be rest assured that their motor activity is secure and that better water management can be made through the use of this project. The project will allow for improving the efficiency of the irrigation process.

CONCLUSION

In implementation of a GSM based irrigation controller system for monitoring and control of irrigation systems using SMS technology this enables users to take advantage of the globally

deployed GSM networks with its low SMS service cost to use mobile phones and simple SMS commands to manage their irrigation system. It will be possible for users to use SMS to monitor directly the conditions of their farmland, schedule the water needs of crops, automatically control watering, and set control operational conditions in accordance with the water needs of crops. This will help minimize overwatering and crop production cost. Further, it will help users to take advantage of the prevailing GSM networks to provide value added services

REFERENCES

- [1] Luxuan Yang and Jinfeng Deng "Irrigation Security of Reclaimed Water Based on Water Quality in Beijing", 2010 IEEE.
- [2] Real-time automation of agricultural environment for modernization of Indian agricultural system". 2010 International Journal of Computer Applications (0975 - 8887) Volume 1 No. 22.
- [3] F.H. Tani, S. Barrington. "Zinc and copper uptake by plants under two transpiration rates. Part I. Wheat (*Triticum aestivum* L.)," *Environmental Pollution*, 138. pp. 538-547, 2005.
- [4] John Baillieul, Fellow IEEE, and Panos J. Antsaklis, Fellow IEEE. "Control and Communication Challenges in Networked Real-Time Systems."
- [5] David E. Simon, "An Embedded Software Primer", fth edition, 2007.
- [6] www.keil.com 8.GSM4beginners, December.2000
- [7] <http://electronics.howstuworke.com/gadgets/travel/gps.htm>
- [8] <http://en.wikipedia.org/wiki/GSM>
- [9] Kay, M., "Smallholder irrigation technology: Prospects for sub-Saharan Africa" International Program for Technology and Research in Irrigation and Drainage, FAO, Rome, 2001, pp. 125.
- [10] Fangmeier, D. D., Garrot, D. J., Mancino, C.F., Husman, S. H., "Automated irrigation systems using plant and soil sensors", *American Society of Agricultural Engineers, ASAE Publication* 04-90, 1990, pp. 533-537.
- [11] Benzekri, A., Meghrich, K., and Refou, L., "PC-based automation of a multi-mode control for an irrigation system" *Proceedings of International symposium on industrial embedded systems*, Lisbon, July 2007, pp. 310-315.
- [12] Shinghal, K., Noor, A., Srivastava, N., and Singh, R., *Wireless sensor networks in agriculture for potato farming* International Journal of Engineering, Science and Technology, Vol. 2, No. 8, 2010, pp. 3955-3963.
- [13] Gautam, I., and Reddy, S. R. N., "Innovative GSM-Bluetooth based remote controlled embedded system for irrigation", *International Journal of Computer Applications*, Vol. 47, No. 8, 2012, pp. 1.
- [14] Zhang, F., Yang, M., and Ying, H., "The application of GSM communication in agricultural automation", *Journal of Technology for Agriculture*, Vol. 1, No. 1, 2004, pp. 39-41.
- [15] Yang, G., Liu, Y., Zhao, L., Cui, S., Meng, Q., and Chen, H., "Automatic irrigation system based on wireless network" *Proceedings of 8th IEEE Conference on Control and Automation*, Xiamen, June 2010, pp. 2120-2125.