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Control of irrigation automatically by using wireless Sensor network

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ABSTRACT

This paper proposes a design for home automation system using ready to use, cost effective and efficient devices including raspberry pi, arduino Micro controllers efficient, energy xbee modules and relay boards. Use of these components results in overall cost effective, scalable and robust implementation of system. The commands from the user are processed at raspberry pi using python programming language. Arduino microcontrollers are used to receive the on/off commands from the rasperry pi using zigbee protocol. Star zigbee topology serves as backbone for the communication between raspberry pi and end devices. Raspberry pi acts a central coordinator and end devices act as various routers. Low-cost and energy efficient drip irrigation system serves as a proof of concept. The design can be used in big agriculture fields as well as in small gardens via just sending an email to the system to water plants. The use of ultrasound sensors and solenoid valves make a smart drip irrigation system. The paper explains the complete installation of the system including hardware and software aspects to identify the moisture content in the soil in-order to control the water flow as well as the electrical flow.

I.INTRODUTION

The requirement of building an automation system for an office or home is increasing day-by-day. Industrialist and researches are working to build efficient and economic automatic systems to control different machines like lights, fans, air conditioners based on the requirement. Automation makes an efficient use of the electricity and water and reduces much of the wastage. Drip irrigation system makes the efficient use of water and fertilizer. Water is slowly dripped to the roots of the plants through narrow tubes and valves. Water is fed directly to the base of the plants which is a perfect way to water plants. There should be proper drainage in the fields or pot plants to avoid any water logging which in case may affect the productivity. There already exist automatic drip irrigation systems which water plants based on soil humidity, pH value of soil, temperature and light. These parameters are required in big agricultural fields where productivity of the crop matters. In small areas like office premises, buildings, house gardens etc. where watering plants at regular interval matters, our proposed irrigation system will be very efficient. This paper presents a smart drip irrigation system to water plants with the use of devices like raspberry pi, Arduino microcontrollers.

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II.CONTROL BLOCK

Raspberry pi is a pocket personal computer with Linux operating system installed on it. This is super cheap to encourage young people for learning, programming, experimenting and innovation. Resembling like motherboard, raspberry pi has all the components to connect inputs, outputs and storage.

CPU/GPU: This is a Broadcom BCM2835 System on a Chip (SoC) that's made up of an ARM central Processing unit (CPU) and a Video core 4 graphics processing unit (GPU).

B. GPIO: These are general purpose input/output connection points

.*C.* RCA: This allows connection with analog TV or other similar points

D. Audio Out: This point provides connection with audio out devices like speakers or headphones

.*E.* LED: This is used for indicator lights.

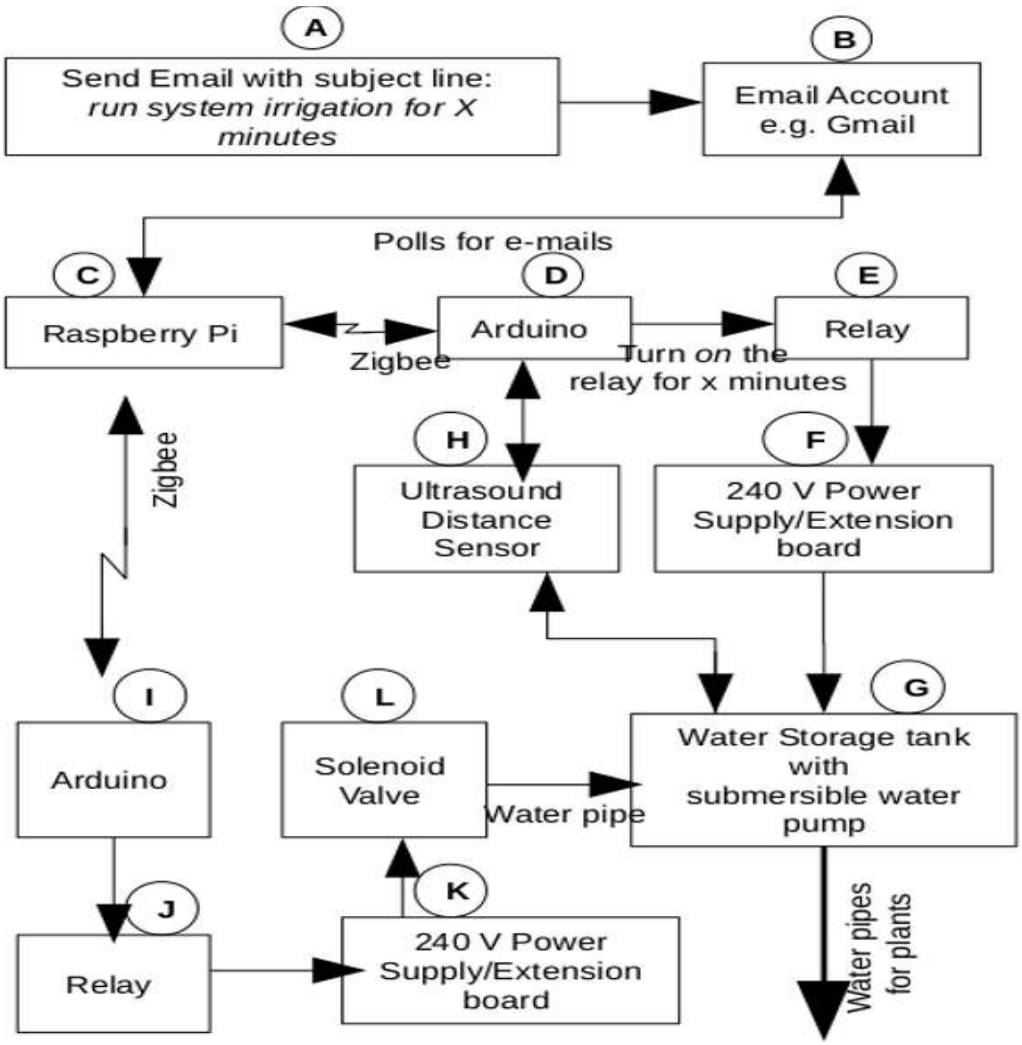

Fig 1 proposed system.

III.PROPOSED METHOD

Raspberry Pi*:* Model B of Raspberry is used in this paper. As soon as the email is received, one of the GPIO is turned *high.* A program written in Python programming language has been used to receive email and turning a GPIO pin *high* for the requested duration. The same program also sends the status updates to user's email address. Software libraries used in Python.

Arduino*:* It is an open source micrcontroller which is used to control relay and ultrasound distance sensor. Free arduino flavor of arduino is used in this design. Arudino libraries and functions are used in the progam (not shown). In case a low water level is detected by the sensor (part H) then a signal will be sent from the microcontroller to pi. Pi will replay the same signal to arduino (part I) and solenoid valve (part L) will be turned *on* via relay. Figure 1 explains the communication circuitry between arduino and zigbee module. Figure 1 also explains the connection between the arduino and sensor (part H) as well as arduino and relay.

Relay Board*:* One-channel relay board which operates on 5-6V is used here. The circuit is used to control one 240V power appliance directly from microcontrollers or low voltage circuits. The connections to one-channel relay board are shown in Fig. 1 There are three pins
On the relay board namely *normally open (NO), normally closed (NC)* and *common (C).* The *common* pin is connected to *NC* pin when the relay is *off* and to the *NO* pin when the relay is *on.* The input pin "INP" receives logic *high* from raspberry pi and in turn switches *on* the relay, thus *common* is connected to NO which turns the device *on* till the relay is *on.* The "VCC" and "GND" pins of the relay are connected to 5V
Supply and ground respectively.

Power Supply: The device to be switched, here, is an electrical water pump which runs on 240V supply. Its one end is connected to the 240 V AC supply and the other end is connected to *NO* pin of the relay board.

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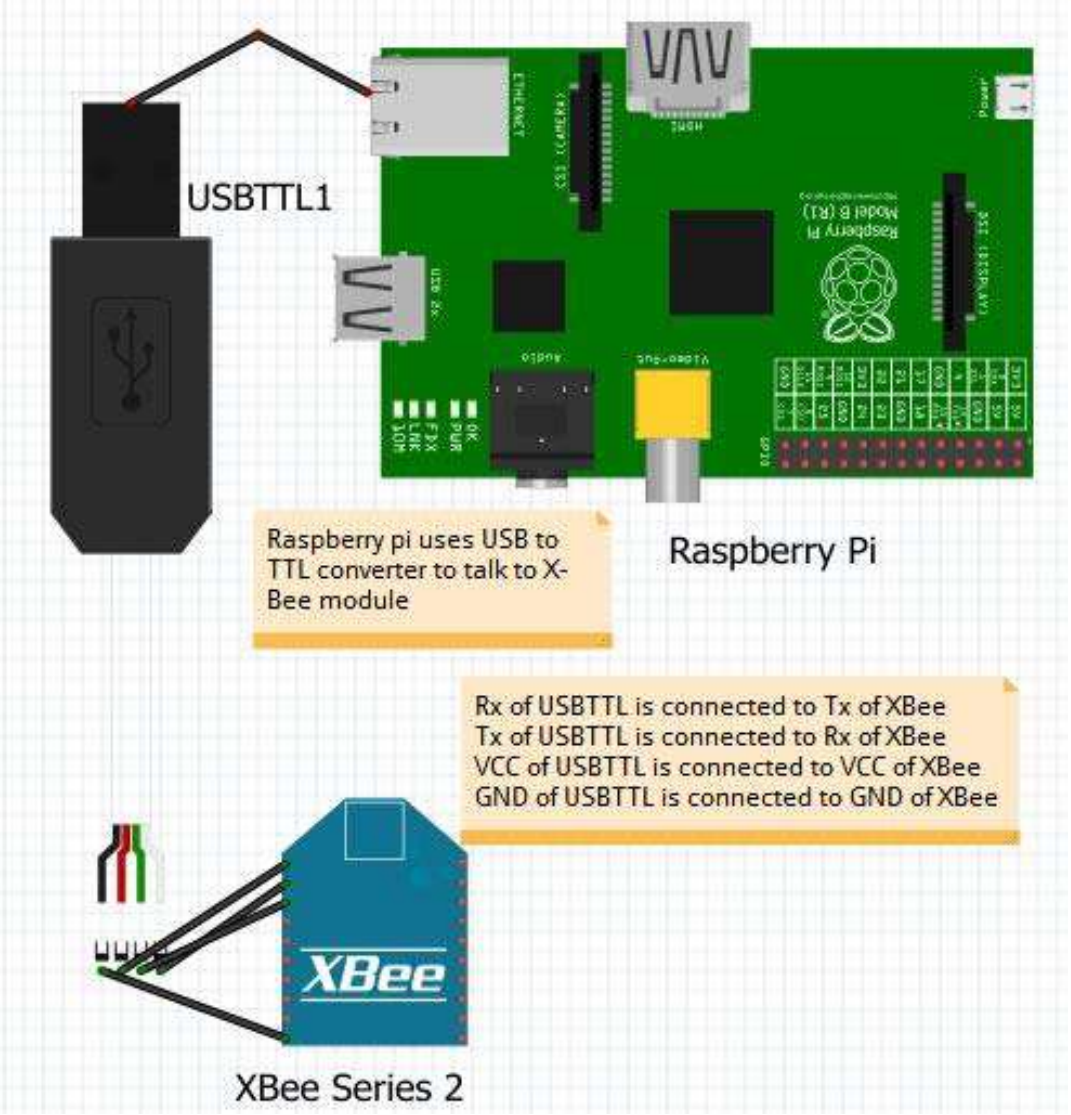

Fig 2 pi and zigbee communication circuit

Water Storage Tank and water pump*:* Two 30 liters water storage tanks are used for testing purpose. Each tank has submersible water pumps with the rating of 220V/50Hz. It draws the current of 0.23A and power of 18W. The main water pipe is fed back to the water tank to avoid any water wastage. Water tank has ultrasound distance sensor which keeps a track of water depth in the tank. As soon as the water level falls below a threshold level, a signal is sent to microcontroller to open solenoid valve which is attached to the water tap and thus the water can be refilled into the water tank.

Ultrasound Distance Sensor*:* This sensor is used to measure the water level in the tank. The *on/off* signal is continously sent to the solenoid valve and thus the water level in tank does not drop below or above a threshold

to avoid any damage in the water pump and also to avoid overflow of water from the water tank. The communication from sensor till solenoid valve is as follow

a) Ultrasound sensor send signal to microcontroller.

b) Arduino (D) communicate the signal to pi

c) Pi again sends the signal to arduino (I) via zigbee

IV.CONCLUSION

This smart drip irrigation system proves to be a useful system as it automates and regulates the watering without any manual intervention. Sending the emails to the system can be automated but manual sending of the emails has control over the system regarding whether or not to run the system depending upon the weather conditions. Using this system, solenoid valves and relay board can be controlled remotely which opens the opportunities to control the water flow as well as the electrical flow.

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