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Smart City Using Arduino

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[Keywords: Smart, City, Smart-Parking, RFID, Sensors, Arduino, Ultrasonic Sensor, IoT, Smart Plant watering, Automatic Dam Control, Adaptive Street Light, Energy Generation, Smart Windmill, Automatic Water Dispenser]

Abstract: *In the present scenario, our dependence on digitalized machines has increased a lot. To decrease it we need to handle the same dependence in a smarter manner. Therefore a* ***Smart City*** *is defined as the ability to integrate multiple technological solutions in a secure fashion to manage the city's assets—the city's assets include, but not limited to, local departments information systems, schools, libraries, transportation systems, hospitals, power plants, law enforcement, and other community services. The goal of building a smart city is to improve the quality of life by using technology to improve the efficiency of services and meet residents' needs.*

I. *INTRODUCTION:*

'Smart cities' is a term used to describe the use of smart technologies and data as the means to solve cities' sustainability challenges. Many cities are in the process of making themselves smart, using data and technology to improve transport, energy use, health, and air quality or to drive economic growth. Others are being built to be smart from the start. So this is a term that relates to the present and to the future.

The components which we use are:

1 – Radio-Frequency Identification (RFID) Tags,
2 – Arduino UNO,
3 – Water Sensor,
4 – Soil Moisture Sensor,
5 – Infrared (IR) Sensor,
6 – Ultrasonic Sensor,
7 – LEDs, and,
8 – Submersible 5v Air Pump.

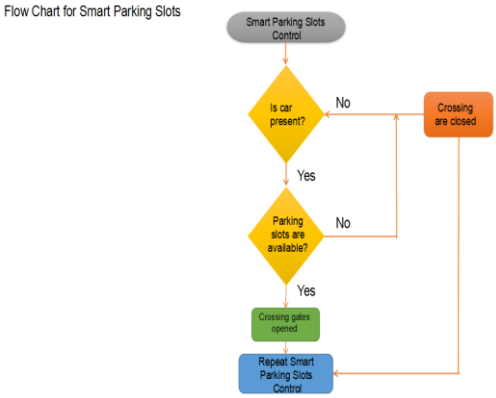
II. *OBJECTIVES:*

Our Objectives primarily focuses on the following:

1 – Automated parking for cars required minimal or no guards for monitoring.
2 – Smart gate entry for in-bound city traffic for prevention of non-recognized entry.
3 – Smart Plant watering system so as to dedicate our time to other important work in our lives as the plants can now remain watered even when we are in a different location.
4 – Automation of dam gate so as to prevent flooding during excess rains and no tension of opening the gates as the water sensors take the responsibility.
5 - Adaptive street lightings which will adjust its brightness based on the intensity of traffic so as to cut down the load on electricity,
6 – Automated Dispenser of purified water for emergency use to public that to without any wastage of it as we all know about the shortage of freshwater nowadays, and,
7 – Smart Windmill which will extend its flaps during slow wind speeds and contract during faster winds.

IoT based Smart Parking:

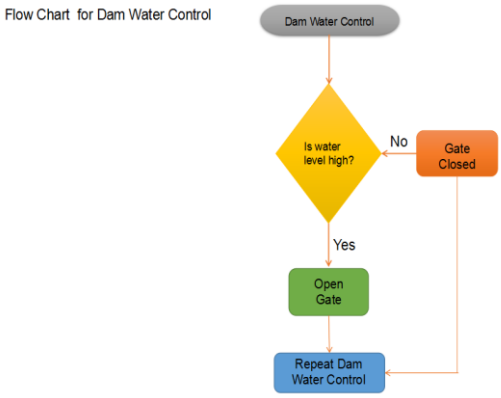
A Smart vehicle parking system helps



drivers find a vacant spot. Using sensors in each parking space that detect the presence or absence of a vehicle, signs direct incoming drivers to available locations. For example, in the early 2000s, a smart parking system was installed at the Baltimore-Washington International Airport. Prior to installation, the parking garages closed when they were about 90% filled. With the Smart Park system, the garages close only at 99% occupancy. Smart Parking's Smart-Park system is a complete, end-to-end solution that pairs a network of sensors, feature displays and live gateways with a powerful and intuitive web-based platform.
Infinitely scalable, the beauty of our system lies in the user-friendly dashboard which enables customers to manage and analyses events and information, as well as allowing users to identify trends and interpret data.

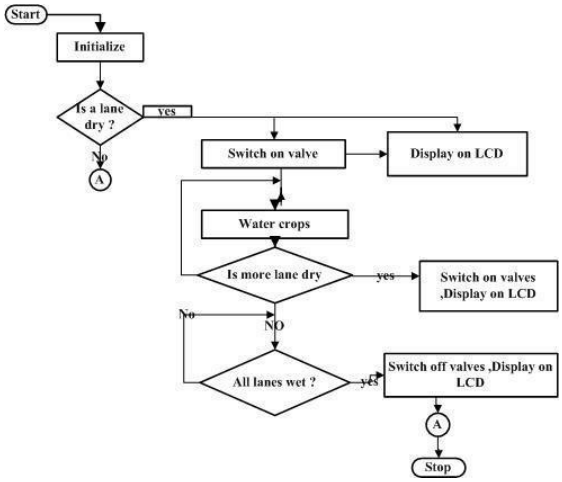
Automatic Dam Water Control:

We had proposed an automatic dam water level monitor and controller system. Our proposed project uses sensors to sense the water level and then opens the dam gate (motor used to demonstrate as dam gate) according to the water level. Our system uses multiple water level sensors (float sensors) for these purposes.
The sensors are mounted at three different levels in order to check water level and provide signals accordingly. When water reaches first sensor it is sensed by it and displayed.



When water reaches second sensor it provides a signal to the microcontroller and it opens the dam gate partially. As soon as the water level reaches the third sensor, it signals the microcontroller and the microcontroller then signals the motor to run, which is demonstrated as opening the dam gate fully. Thus our proposed system allows for automatic dam gate **opening based on water level sensing.**

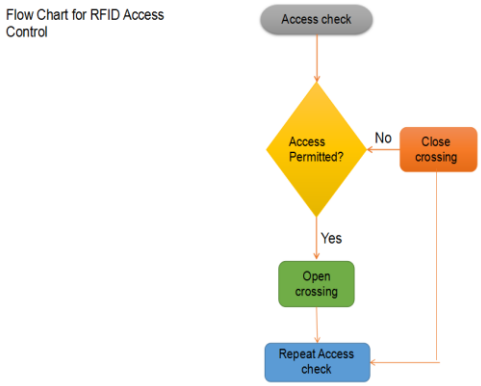
Automatic Plant Watering System:



This project aims at watering the plants remotely from any place in the world by using a soil moisture sensor that will light up a LED at a certain moisture level. It uses Arduino microcontroller board. Two wires placed in the soil pot form a variable resistor, whose resistance varies depending on soil moisture. This variable resistor is connected in a voltage divider configuration, and Arduino collects a

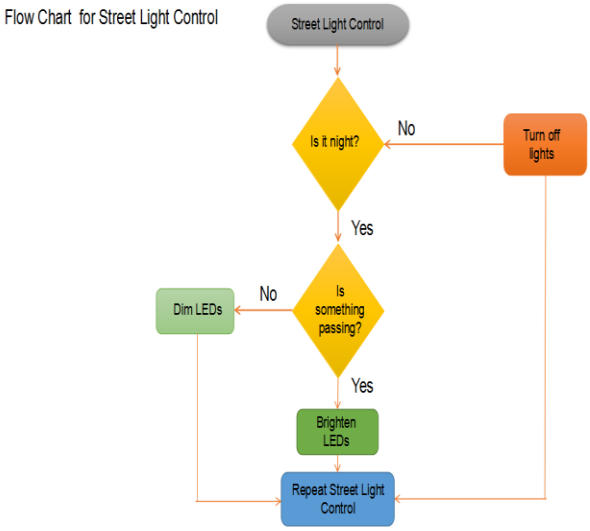
voltage proportional to resistance between the 2 wires. During day to day activities many people often forget to water their plants and thus it becomes challenging for them to keep their plants healthy and alive. Also it is a challenge for farmers to maintain their fields and manage watering of plants during shortage of water. Based on the above background, we thought that it is necessary to implement the automated system which will take care of plants considering all the different aspects of home gardening system (for system based on household purpose) as well as larger landscape (for the system based on agricultural farms) and helps them to grow healthy.

RFID Gate Security:



Here in our project, One UHF Reader is mounted at the Entry & Exit Gates. These readers can read the UHD Cards / Stickers / Tags from 10~12 meter distance and OPENS the gate. This system avoids physical verification of registered vehicles. RFID principle of operation depends on tagging objects to identify them and the tags do not need to be visible. They are divided into three types: the first type was passive RFID tags that are powered by the energy that the reader's signal induces in their antennas; the second one was active tags that have its own power supply and finally semi-active tags in between. RFID technology participated in markets such as access control, sensors and metering applications, payment systems, communication and transportation, parcel and document tracking, distribution logistics, automotive systems, livestock / pet tracking, and hospitals / pharmaceutical applications.
The first Radio Frequency Identification transponder system is created in 1973 and then this technology evolved rapidly through the 1980s and 1990s. Huge progress has been made over the last 10 years. Recently and due to the development of integrated circuits, radios and increased commercial interest, the world moved widely toward this technology.

IoT based Adaptive Street Light Control:

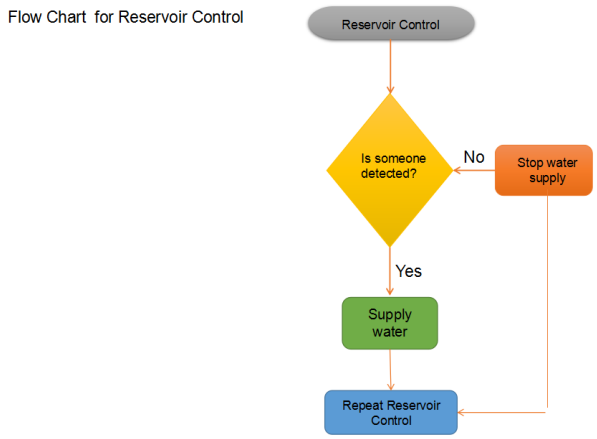


Here we have shown Adaptive Intelligent **street lighting** which refers to Public Street **lighting** that adapts to movement by pedestrians, cyclists and cars. Intelligent **street lighting** also referred to as adaptive **street lighting**, dims when no activity is detected, but brightens when movement is detected. Photocells are **light**-sensitive **sensors** that respond to the amount of **light** detected. When the **light** is too low, such as at dusk or under heavy overcast skies, the sensor tells the computing unit within the streetlight to activate the flow of electricity.
Electricity is sent through high-intensity discharge **lamps**. Photocells are **light**-sensitive **sensors** that respond to the

amount of **light** detected. When the **light** is too low, such as at dusk or under heavy overcast skies, the sensor tells the computing unit within the streetlight to activate the flow of electricity. Electricity is sent through high-intensity discharge **lamps**.

Automatic Drinking Water-dispensing Reservoir Control:

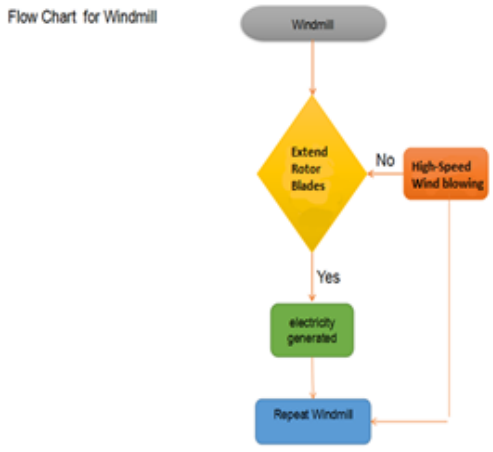
The water that comes for our day-to-day life from the city's pipelines, the source being the reservoir, is managed through a lot of human intervention. It might not appear big at the first time, but if your tap dripped a drop of water once every second it would take only about five hours for you to waste one gallon of water, that is enough water for an average human to survive for two days. When any obstacle is detected the tap will dispense on its own and close when removed.
Below it shows how the reservoir will be controlled:



Reservoir is a water conservancy project of flood control and water storage, building a reservoir in the upper reaches of the river used for urban water supply, tap water and agricultural irrigation, power generation, flood control reducing peak flow into the downstream channel through the capacity of storing flood, to achieve flood control function and multi-water storage in flood season. The safety of reservoir in flood season is affected by many factors, and gate control system is accurate, timely control of the gate of the reservoir, so its reliability is a major factor affecting the safe operation of the reservoir. So here in this project I have demonstrated **Automatic Water Dispenser (as a reservoir) using Arduino and a Solenoid valve**.

Energy Generation using Smart Windmill:

Here the momentum theory with the help of Telescopic blade concept uses the idea of extending the turbine blades when wind speeds fall below rated level, hence increasing the swept area, and thus maintaining a relatively high power output. It is shown for a typical site that the annual energy output of such a wind turbine that could double its blade length, could be twice that of a corresponding turbine with fixed length blades. From a cost analysis, it is shown that the concept would be feasible if the cost of the rotor could be kept less than 4.3 times the cost of a standard rotor with fixed length blades.



III. *CONTRIBUTION:*

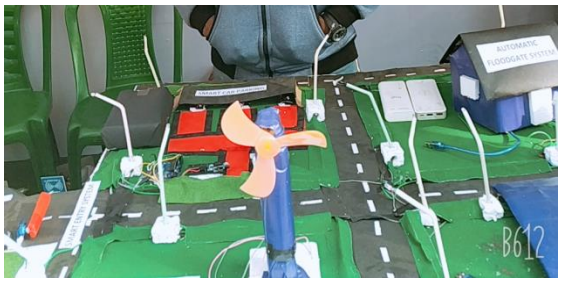
Our Project is based on developing and organizing the prospects planned in a city but in a smarter way providing as minimal intervention as possible, but designed in such a way the even that minimal effort might be waived off in the future with the

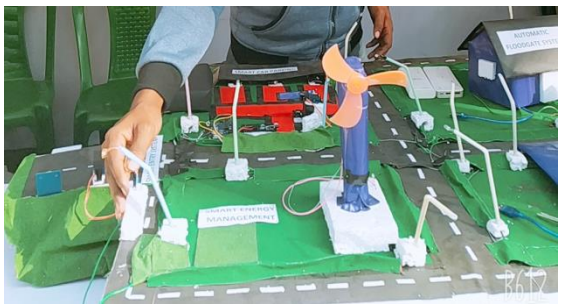
booming technological aspects of Artificial Intelligence everywhere.
We have dedicated our effort in every possible way for minimal government expenditure for the execution of the smart city mission.
The whole idea of smart city is to solve problems for the citizens and authority that manages the city. The concept is to have high efficiency city operations that help to improve the quality of life for its citizens. The concept usually connects IT and Data management with a lot of other technology adoption such as wireless sensor and other IoTs.
It was since the beginning and will always be about technology. ICT and IoT are a huge and important part of the drivers.
1 – Out contributions focuses on a wide range of electronic and digital technologies to communities and cities.
2 – We have tried to prove the paradigm has changed; the most successful projects we see now are based on citizens-centred strategies.
3 – Our main goal of doing smarter cities is to increase the life quality in the cities.
4 - All the new economical approaches such as Circular Economy, creative Economy, Sharing economy and co-creation. And,
5 -Any definition about smart city should mention resilience on it. Smart City strategy nowadays is not only for big cities, but also for villages.

IV. *CONCLUSION:*

We can conclude that the Arduino has everything that is required by the user which includes its inbuilt converter, I/O pins etc. With the combination of Arduino, and the Bluetooth Shield we can control over many other things, like home Lightings, air conditioner and many more through our cell phones. The Arduino can also contribute at large for the Smart-Home system. By doing this Project we found out a lot about the Arduino, and how it has made us easier to convert digital signals into physical movements.
Technology is driving the way city officials interact with the community and the city infrastructure. Through the use of real-time systems and sensors, data are collected from citizens and objects—then processed in real-time. The information and knowledge gathered are keys to tackling inefficiency. Technology can be used as an enabler to tell what is happening in the city, how the city is evolving, and how to enable a better quality of life. Business drives technology and large-scale urbanization drives innovation and new technologies.
The UN Strategy on Sustainable Urban Development highlights digital transformation and new technologies as one of four frontier issues that require a special, coordinated response.

Below are the images of the actual Project:





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