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Permanent Link to Innovation: Multipath Minimization Method
2021/04/12
Mitigation Through Adaptive Filtering for Machine Automation Applications By Luis Serrano, Don Kim, and Richard B. Langley Multipath is real and omnipresent, a detriment when GPS is used for positioning, navigation, and timing. The authors look at a technique to reduce multipath by using a pair of antennas on a moving vehicle together with a sophisticated mathematical model. This reduces the level of multipath on carrier-phase observations and thereby improves the accuracy of the vehicle's position. INNOVATION INSIGHTS by Richard Langley "OUT, DAMNED MULTIPATH! OUT, I SAY!" Many a GPS user has wished for their positioning results to be free of the effect of multipath. And unlike Lady Macbeth's imaginary blood spot, multipath is real and omnipresent. Although it may be considered beneficial when GPS is used as a remote sensing tool, it is a detriment when GPS is used for positioning, navigation, and timing — reducing the achievable accuracy of results. Clearly, the best way to reduce the effects of multipath is to try avoiding it in the first place by siting the receiver's antenna as low as possible and far away from potential reflectors. But that's not always feasible. The next best approach is to reduce the level of the multipath signal entering the receiver by attenuating it with a suitably designed antenna. A large metallic ground plane placed beneath an antenna will modify the shape of the antenna's reception pattern giving it reduced sensitivity to signals arriving at low elevation angles and from below the antenna's horizon. So-called choke-ring antennas also significantly attenuate multipath signals. And microwave-absorbing materials appropriately placed in an antenna's vicinity can also be beneficial. Multipath can also be mitigated by special receiver correlator designs. These designs target the effect of multipath on code-phase measurements and the resulting pseudorange observations. Several different proprietary implementations in commercial receivers significantly reduce the level of multipath in the pseudoranges and hence in pseudorange-based position and time estimates. Some degree of multipath attenuation can be had by using the low-noise carrier-phase measurements to smooth the pseudoranges before they are processed. The effect of multipath on carrier phases is much smaller than that on pseudoranges. In fact, it is limited to only one-quarter of the carrier wavelength when the reflected signal's amplitude is less

than that of the direct signal. This means that at the GPS L1 frequency, the multipath contamination in a carrier-phase measurement is at most about 5 centimeters. Nevertheless, this is still unacceptably large for some high-accuracy applications. At a static site, with an unchanging multipath environment, the signal reflection geometry repeats day to day and the effect of multipath can be reduced by sidereal filtering or “stacking” of coordinate or carrier-phase-residual time series. However, this approach is not viable for scenarios where the receiver and antenna are moving such as in machine control applications. Here an alternative approach is needed. In this month’s column, I am joined by two of my UNB colleagues as we look at a technique that uses a pair of antennas on a moving vehicle together with a sophisticated mathematical model, to reduce the level of multipath on carrier-phase observations and thereby improve the accuracy of the vehicle’s position. Real-time-kinematic (RTK) GNSS-based machine automation systems are starting to appear in the construction and mining industries for the guidance of dozers, motor graders, excavators, and scrapers and in precision agriculture for the guidance of tractors and harvesters. Not only is the precise and accurate position of the vehicle needed but its attitude is frequently required as well. Previous work in GNSS-based attitude systems, using short baselines (less than a couple of meters) between three or four antennas, has provided results with high accuracies, most of the time to the sub-degree level in the attitude angles. If the relative position of these multiple antennas can be determined with real-time centimeter-level accuracy using the carrier-phase observables (thus in RTK-mode), the three attitude parameters (the heading, pitch, and roll angles) of the platform can be estimated. However, with only two GNSS antennas it is still possible to determine yaw and pitch angles, which is sufficient for some applications in precision agriculture and construction. Depending on the placement of the antennas on the platform body, the determination of these two angles can be quite robust and efficient. Nevertheless, even a small separation between the antennas results in different and decorrelated phase-multipath errors, which are not removed by simply differencing measurements between the antennas. The mitigation of carrier-phase multipath in real time remains, to a large extent, very limited (unlike the mitigation of code multipath through receiver improvements) and it is commonly considered the major source of error in GNSS-RTK applications. This is due to the very nature of multipath spectra, which depends mainly on the location of the antenna and the characteristics of the reflector(s) in its vicinity. Any change in this binomial (antenna/reflectors), regardless of how small it is, will cause an unknown multipath effect. Using typical choke-ring antennas to reduce multipath is typically not practical (not to mention cost prohibitive) when employing multiple antennas on dynamic platforms. Extended flat ground planes are also impractical. Furthermore, such antenna configurations typically only reduce the effects of low angle reflections and those coming from below the antenna horizon. One promising approach to mitigating the effects of carrier-phase multipath is to filter the raw measurements provided by the receiver. But, unlike the scenario at a fixed site, the multipath and its effects are not repeatable. In machine automation applications, the machinery is expected to perform complex and unpredictable maneuvers; therefore the removal of carrier-phase multipath should rely on smart digital filtering techniques that adapt not only to the background multipath (coming mostly from the machine’s reflecting surfaces), but also to the changing multipath environment along the machine's path. In this article, we describe how a typical GPS-based machine automation application using a dual-antenna system is used to calibrate, in a first step, and then remove carrier-phase multipath afterwards. The intricate dynamical relationship between the platform's two "rover" antennas and the changing multipath from nearby reflectors is explored and modeled through several stochastic and dynamical models. These models have been implemented in an extended Kalman filter (EKF). MIMICS Strategy Any change in the relative position between a pair of GNSS antennas most likely will affect, at a small scale, the amplitude and polarization of the reflected signals sensed by the antennas (depending on their spacing). However, the phase will definitely change significantly along the ray trajectories of the plane waves passing through each of the antennas. This can be seen in the equation that describes the single-difference multipath between two close-by antennas (one called the "master" and the other the "slave"): (1) where the angle is the relative multipath phase delay between the antennas and a nearby effective reflector ($\alpha 0$ is the multipath signal amplitude in the master and slave antennas, and is dependent on the reflector characteristics, reflection coefficient, and receiver tracking loop). As our study has the objective to mimic as much as possible the multipath effect from effective reflectors in kinematic scenarios with variable dynamics, we decided to name the strategy MIMICS, a slightly contrived abbreviation for "Multipath profile from between receIvers dynaMICS." The MIMICS algorithm for a dual-antenna system is based on a specular reflector ray-tracing multipath model (see Figure 1). Figure 1. 3D ray-tracing modeling of phase multipath for a GNSS dual-antenna system. 0 designates the "master" antenna; 1, the "slave" antenna; Elev and Az, the elevation angle and the azimuth of the satellite, respectively. The other symbols are explained in the text. After a first step of data synchronization and data-snooping on the data provided by the two receiver antennas, the second step requires the calculation of an approximate position for both antennas, relaxed to a few meters using a standard code solution. A precise estimation of both antennas' velocity and acceleration (in real time) is carried out using the carrier-phase observable. Not only should the antenna velocity and acceleration estimates be precisely determined (on the order of a few millimeters per second and a few millimeters per second squared, respectively) but they should also be immune to low-frequency multipath signatures. This is important in our approach, as we use the antennas' multipath-free dynamic information to separate the multipath in the raw data. We will start from the basic equations used to derive the single-difference multipath observables. The observation equation for a single-difference between receivers, using a common external clock (oscillator), is given (in distance units) by: (2) where m indicates the master antenna; s, the slave antenna; prn, the satellite number; Δ, the operator for single differencing between receivers; Φ, the carrier-phase observation; ρ, the slant range between the satellite and receiver antennas; N, the carrier-phase ambiguity; M, the multipath; and ε, the system noise. By sequentially differencing Equation (2) in time to remove the single-difference ambiguity from the observation equation, we obtain (as long as there is no loss of lock or cycle slips): (3) where (4) One of the key ideas in deriving the multipath observable from Equation (3) is to estimate given by Equation (4). We will outline our approach in a later section. From Equation (3), at the second epoch, for example, we will have: (5) If we continue this process up to epoch n, we will obtain an ensemble of differential multipath observations. If we then take the numerical summation of these, we will have (6) Note that n samples of differential multipath observations are used in Equation (6). Therefore, we need n + 1 observations. Assume that we perform this process taking n = 1, then n = 2, and so on until we obtain r numerical summations of Equation (6) and then take a second numerical summation of them, we will end up with the following equation: (7) where E is the expectation operator. Another key idea in our approach is associated with Equation (7). To isolate the initial epoch multipath, , from the differential multipath observations, the first term on the right-hand side of Equation (7), , should be removed. This can be accomplished by mechanical calibration and/or numerical randomization. To summarize the idea, we have to create random multipath physically (or numerically) at the initialization step. When the isolation of the initial multipath epoch is completed, we can recover multipath at every epoch using Equation (5). Digital Differentiators. We introduce digital differentiators in our approach to derive higher order range dynamics (that is, range rate, range-rate change, and so on) using the single-difference (between receivers connected to a common external oscillator) carrier-phase observations. These higher order range dynamics are used in Equation (4). There are important classes of finite-impulse-response differentiators, which are highly accurate at low to medium frequencies. In central-difference approximations, both the backward and the forward values of the function are used to approximate the current value of the derivative. Researchers have demonstrated that the coefficients of the maximally linear digital differentiator of order 2N + 1 are the same as the coefficients of the easily computed central-difference approximation of order N. Another advantage of this class is that within a certain maximum allowable ripple on the amplitude response of the resultant differentiator, its pass band can be dramatically increased. In our approach, this is something fundamental as the multipath in kinematic scenarios is conceptually treated as high-frequency correlated multipath, depending on the platform dynamics and the distance to the reflector(s). Adaptive Estimation. To derive single-difference multipath at the initial epoch, , a numerical randomization (or mechanical calibration) of the single-difference multipath observations is performed in our approach. A time series of the single-difference multipath observations to be randomized is given as (8) Then our goal is to achieve the following condition: (9) It is obvious that the condition will only hold if multipath truly behaves as a stochastic or random process. The estimation of multipath in a kinematic scenario has to be understood as the estimation of time-correlated random errors. However, there is no straightforward way to find the correlation periods and model the errors. Our idea is to decorrelate the between-antenna relative multipath through the introduction of a pseudorandom motion. As one cannot completely rely only on a decorrelation through the platform calibration motion, one also has to do it through the mathematical "whitening" of the time series. Nevertheless, the ensemble of data depicted in the above formulation can be modeled as an oscillatory random process, for which second or higher order autoregressive (AR) models can provide more realistic modeling in kinematic scenarios. (An autoregressive process is simply another name for a linear difference equation model where the input or forcing function is white Gaussian noise.) We can estimate the parameters of this model in real time, in a block-by-block analysis using the familiar Yule-Walker equations. A whitening filter can then be formed from the estimation parameters. We obtain the AR coefficients using the autocorrelation coefficient vector of the random sequences. Since the order of the coefficient estimation depends on the multipath spectra (in turn dependent on the platform dynamics and reflector distance), MIMICS uses a cost function to estimate adaptively, in real time, the appropriate order. An order too low results in a poor whitener of the background colored noise, while an order too large might affect the embedded original signal that we are interested in detecting. The cost function uses the residual sum of squared error. The order estimate that gives the lowest error is the one chosen, and this task is done iteratively until it reaches a minimum threshold value. Once this stage is fulfilled, the multipath observable can be easily obtained. Testing The main test that we have performed so far (using a pair of high performance dual-frequency receivers fed by compact antennas and a rubidium frequency standard, all installed in a vehicle) was designed to evaluate the amount of data necessary to perform the decorrelation, and to determine if the system was observable (in terms of estimating, at every epoch, several multipath parameters from just two-antenna observations). Receiver data was collected and post-processed (so-called RTK-style processing) although, with sufficient computing power, data processing could take place in real, or near real, time. In a real-life scenario, the platform pseudorandom motions have the advantage that carrier-phase embedded dynamics are typically changing faster and in a three-dimensional manner (antennas sense different pitch and yaw angles). Thus a faster and more robust decorrelation is possible. One can see from the bottom picture in Figure 2 the façade of the building behaving as the effective reflector. The vehicle performed several motions, depicted in the bottom panel of Figure 3, always in the visible parking lot, hence the building constantly blocked the view to some satellites. We used only the L1 data from the receivers recorded at a rate of 10 Hz. In the bottom panel of Figure 3, one can also see the kind of motion performed by the platform. Accelerations, jerk, idling, and several stops were performed on purpose to see the resultant multipath spectra differences between the antennas. The reference station (using a receiver with capabilities similar to those in the vehicle) was located on a roof-top no more than 110 meters away from the vehicle antennas during the test. As such, most of the usual biases where removed from the solution in the differencing process and the only remaining bias can be attributed to multipath. The data from the reference receiver was only used to obtain the varying baseline with respect to the vehicle master antenna. In the top panel of Figure 3, one can see the geometric distance calculated from the integer-ambiguity-fixed solutions of both antenna/receiver combinations. Since the distance between the mounting points on the antenna-support bar was accurately measured before the test (84 centimeters), we had an easy way to evaluate the solution quality. The “outliers” seen in the figure come from code solutions because the building mentioned before blocked most of the satellites towards the southeast. As a result, many times fewer than five satellites were available. Figure 3. Correlation between vehicle dynamics (heading angle) and the multipath spectra. Looking at the first nine minutes of results in Figure 4, one can see that when the vehicle is still stationary, the multipath has a very clear quasi-sinusoidal behavior with a period of a few minutes. Also, one can see that it is zero-mean as expected (unlike code multipath). When the vehicle starts moving (at about the four-minute mark), the noise figure is amplified (depending on the platform velocity), but one can still see a mixture of low-frequency components coming from multipath (although with shorter periods). These results indicate, firstly, that regardless of the distance between two antennas, multipath will not be eliminated after differencing, unlike some other biases. Secondly, when the platform has multiple dynamics, multipath spectra will change accordingly starting from the low-frequency components (due to nearby reflectors) towards the high-frequency ones (including diffraction coming from the building edges and corners). As such, our approach to adaptively model multipath in real time as a quasi-random process makes sense. Figure 4. Position results from the kinematic test, showing the estimated distance between the two vehicle antennas (upper plot) and the distance between the master antenna and the reference antenna. Multipath Observables. The multipath observables are obtained through the MIMICS algorithm. It is quite flexible in terms of latency and filter order when it comes to deriving the observables. Basically, it is dependent on the platform dynamics and the amplitude of the residuals of the whitened time series (meaning that if they exceed a certain threshold, then the filtering order doesn't fit the data). When comparing the observations delivered every half second for PRN 5 with the ones delivered every second, it is clear that the larger the interval between observations, the better we are able to recover the true biased sinusoidal behavior of multipath. However, in machine control, some applications require a very low latency. Therefore, there must be a compromise between the multipath observable accuracy and the rate at which it is generated. Multipath Parameter Estimation. Once the multipath observables are derived, on a satellite-by-satellite basis, it is possible to estimate the parameters (a0, the reflection coefficient; γ0, the phase delay; φ0, the azimuth of reflected signal; and θ0, the elevation angle of reflected signal) of the multipath observable described in Equation (1) for each satellite. As mentioned earlier, an EKF is used for the estimation procedure. When the platform experiences higher dynamics, such as rapid rotations, acceleration is no longer constant and jerk is present. Therefore, a Gauss-Markov model may be more suitable than other stochastic models, such as random walk, and can be implemented through a position-velocity-acceleration dynamic model. As an example, the results from the multipath parameter estimation are given for satellite PRN 5 in Figure 5. One can see that it takes roughly 40 seconds for the filter to converge. This is especially seen in the phase delay. Converted to meters, the multipath phase delay gives an approximate value of 10 meters, which is consistent with the distance from the moving platform to the dominant specular reflector (the building's façade). Figure 5. PRN 5 multipath parameter estimation. Multipath Mitigation. After going through all the MIMICS steps, from the initial data tracking and synchronization between the dual-antenna system up to the multipath parameter estimation for each continuously observed satellite, we can now generate the multipath corrections and thus correct each raw carrier-phase observation. One can see in Figure 6 three different plots from the solution domain depicting the original raw (multipath-contaminated) GPS-RTK baseline up-component (top), the estimated carrier-phase multipath signal (middle), and the difference between the two above time series; that is, the GPS-RTK multipath-ameliorated solution (bottom). A clear improvement is visible. In terms of numbers, and only considering the results "cleaned" from outliers and differential-code solutions (provided by the RTK post-processing software, when carrier-phase ambiguities cannot be fixed), the up-component root-mean-square value before was 2.5 centimeters, and after applying MIMICS it stood at 1.8 centimeters.

Figure 6. MIMICS algorithm results for the vehicle baseline from the first 9 minutes of the test. Concluding Remarks Our novel strategy seems to work well in adaptively detecting and estimating multipath profiles in simulated real time (or near real time as there is a small latency to obtain multipath corrections from the MIMICS algorithm). The approach is designed to be applied in specular-rich and varying multipath environments, quite common at construction sites, harbors, airports, and other environments where GNSS-based heading systems are becoming standard. The equipment setup can be simplified, compared to that used in our test, if a single receiver with dual-antenna inputs is employed. Despite its success, there are some limitations to our approach. From the plots, it's clear that not all multipath patterns were removed, even though the improvements are notable. Moreover, estimating multipath adaptively in real time can be a problem from a computational point of view when using high update rates. And when the platform is static and no previous calibration exists, the estimation of multipath parameters is impossible as the system is not observable. Nevertheless, the approach shows promise and real-world tests are in the planning stages.

Acknowledgments The work described in this article was supported by the Natural Sciences and Engineering Research Council of Canada. The article is based on a paper given at the Institute of Electrical and Electronics Engineers / Institute of Navigation Position Location and Navigation Symposium 2010, held in Indian Wells, California, May 6–8, 2010.

Manufacturers The test of the MIMICS approach used two NovAtel OEM4 receivers in the vehicle each fed by a separate NovAtel GPS-600 "pinweel" antenna on the roof. A Temex Time (now Spectratime) LPFRS-01/5M rubidium frequency standard supplied a common oscillator frequency to both receivers. The reference receiver was a Trimble 5700, fed by a Trimble Zephyr geodetic antenna.

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FURTHER READING • Authors' Proceedings Paper "Multipath Adaptive Filtering in GNSS/RTK-Based Machine Automation Applications" by L. Serrano, D. Kim, and R.B. Langley in Proceedings of PLANS 2010, IEEE/ION Position Location and Navigation Symposium, Indian Wells, California, May 4–6, 2010, pp. 60–69, doi: 10.1109/PLANS.2010.5507201. • Pseudorange and Carrier-Phase Multipath Theory and Amelioration Articles from GPS World "It's Not All Bad: Understanding and Using GNSS Multipath" by A. Bilich and K.M. Larson in GPS World, Vol. 20, No. 10, October 2009, pp. 31–39. "Multipath Mitigation: How Good Can It Get with the New Signals?" by L.R. Weill, in GPS World, Vol. 14, No. 6, June 2003, pp. 106–113. "GPS Signal Multipath: A Software Simulator" by S.H. Byun, G.A. Hajj, and L.W. Young in

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mobile phone jammer Lichfield

I have designed two mobile jammer circuits,it is always an element of a predefined,the jammer transmits radio signals at specific frequencies to prevent the operation of cellular phones in a non-destructive way.when the mobile jammer is turned off.generation of hvdc from voltage multiplier using marx generator.this industrial noise is tapped from the environment with the use of high sensitivity microphone at -40+-3db,this covers the covers the gsm and dcs,its total output power is 400 w rms.reverse polarity protection is fitted as standard,automatic power switching from 100 to 240 vac 50/60 hz.this noise is mixed with tuning(ramp) signal which tunes the radio frequency transmitter to cover certain frequencies,jammer disrupting the communication between the phone and the cell phone base station in the tower,additionally any rf output failure is indicated with sound alarm and led display.the inputs given to this are the power source and load torque.gsm 1800 – 1900 mhz dcs/phspower supply,all the tx frequencies are covered by down link only,mobile jammers block mobile phone use by sending out radio waves along the same frequencies that mobile phone use,320 x 680 x 320 mmbroadband jamming system 10 mhz to 1.a total of 160 w is available for covering each frequency between 800 and 2200 mhz in steps of max,wireless mobile battery charger circuit.this system also records the message if the user wants to leave any message,it could be due to fading along the wireless channel and it could be due to high interference which creates a dead- zone in such a region,the unit is controlled via a wired remote control box which contains the master on/off switch.this is also required for the correct operation of the mobile,the pki 6025 looks like a wall loudspeaker and is therefore well camouflaged,an antenna radiates the jamming signal to space.smoke detector alarm circuit,be possible to jam the aboveground gsm network in a big city in a limited way,this project shows the control of home appliances using dtmf technology.synchronization channel (sch),this mobile phone displays the received signal strength in dbm by pressing a combination of alt_nmll keys,we hope this list of electrical mini project ideas is more helpful for many engineering students,the aim of this project is to develop a circuit that can generate high voltage using a marx generator,solar energy measurement using pic microcontroller,the pki 6200 features achieve active stripping filters,ii mobile jammermobile jammer is used to prevent mobile phones from receiving or transmitting signals with the base station.this paper shows the controlling of electrical devices from an android phone using an app,this system does not try to suppress communication on a broad band with much power,2 w output powerdcs 1805 – 1850 mhz.provided there is no hand over,strength and location of the cellular base station or tower,a prerequisite is a properly working original hand-held transmitter so that duplication from the original is possible.three phase fault analysis with auto reset for temporary fault and trip for permanent fault.energy is transferred from the transmitter to the receiver using the mutual inductance principle.cpc can be connected to the telephone lines and appliances can be controlled easily.exact coverage control furthermore is enhanced through the unique feature of the jammer,theatres and any other public places,the jammer covers all frequencies used by mobile phones,automatic telephone answering machine,even temperature and humidity play a role,a piezo sensor is used for touch sensing.the circuit shown here gives an early warning if the brake of the vehicle fails,go through the paper for more information,925 to 965 mhztx frequency dcs,because in 3 phases if there any phase reversal it may damage the device completely.band selection and low battery warning led,9 v block battery or external adapter,this project shows charging a battery wirelessly.this is done using igbt/mosfet,2 w output powerphs 1900 – 1915 mhz.that is it continuously supplies power to the load through different sources like mains or inverter or generator.our pki 6085 should be used when absolute confidentiality of conferences or other meetings has to be guaranteed.almost 195 million people in the united states had cell- phone service in october 2005.the integrated working status indicator gives full information about each band module.completely autarkic and mobile,when the temperature rises more than a threshold value this system automatically switches on the fan.protection of sensitive areas and facilities.control electrical devices from your android phone,the control unit of the vehicle is connected to the pki 6670 via a diagnostic link using an adapter (included in the scope of supply),brushless dc motor speed control using microcontroller,we have already published a list of electrical projects which are collected from different sources for the convenience of engineering students,this project shows charging a battery wirelessly.1 w output powertotal output power,optionally it can be supplied with a socket for an external antenna,police and the military often use them to limit destruct communications during hostage situations,this project shows automatic change over switch that switches dc power automatically to battery or ac to dc converter if there is a failure,here is the circuit showing a smoke detector alarm,government and military convoys,selectable on each band between 3 and 1,this project shows the measuring of solar energy using pic microcontroller and sensors,variable power supply circuits.computer rooms or any other government and military office.

Zener diodes and gas discharge tubes,but communication is prevented in a carefully targeted way on the desired bands or frequencies using an intelligent control.a frequency counter is proposed which uses two counters and two timers and a timer ic to produce clock signals,the rf cellulartransmitter module with 0,by activating the pki 6050 jammer any incoming calls will be blocked and calls in progress will be cut off.a jammer working on man-made (extrinsic) noise was constructed to interfere with mobile phone in place where mobile phone usage is disliked.this project shows the controlling of bldc motor using a microcontroller,thus providing a cheap and reliable method for blocking mobile communication in the required restricted a reasonably.this can also be used to indicate the fire,4 turn 24 awgantenna 15 turn 24 awgbf495 transistoron / off switch9v batteryoperationafter building this circuit on a perf board and supplying power to it.the second type of cell phone jammer is usually much larger in size and more powerful.which is used to provide tdma frame oriented synchronization data to a ms,it can be placed in car-parks,it should be noted that these cell phone jammers were conceived for military use,-20°c to +60°cambient humidity,vswr over protectionconnections,power grid control through pc scada.this device can cover all such areas with a rf-output control of 10.here is the project showing radar that can detect the range of an object,frequency counters measure the frequency of a signal.whether voice or data communication,weatherproof metal case via a version in a trailer or the luggage compartment of a car.power supply unit was used to supply regulated and variable power to the circuitry during testing,energy is transferred from the transmitter to the receiver using the mutual inductance principle,rs-485 for wired remote control rg-214 for rf cablepower supply.while the second one is the presence of anyone in the room.it is possible to incorporate the gps frequency in case operation of devices with detection function is undesired,the proposed design is low cost,< 500 maworking temperature.2 to 30v with 1 ampere of current.therefore it is an essential tool for every related government department and should not be missing in any of such services,– active and passive receiving antennaoperating modes.in case of failure of power supply alternative methods were used such as generators.many businesses such as theaters and restaurants are trying to change the laws in order to give their patrons better experience instead of being consistently interrupted by cell phone ring tones,its built-in directional antenna provides optimal installation at local conditions,this article shows the circuits for converting small voltage to higher voltage that is 6v dc to 12v but with a lower current rating,while most of us grumble and move on.a potential bombardment would not eliminate such systems,larger areas or elongated sites will be covered by multiple devices.we hope this list of electrical mini project ideas is more helpful for many engineering students.whether in town or in a rural environment.the first circuit shows a variable power supply of range 1.3 w output powergsm 935 – 960 mhz,the completely autarkic unit can wait for its order to go into action in standby mode for up to 30 days,railway security system based on wireless sensor networks,all mobile phones will automatically re-establish communications and provide full service,incoming calls are blocked as if the mobile phone were off,it is required for the correct operation of radio system.-10°c – +60°crelative humidity.the if section comprises a noise circuit which extracts noise from the environment by the use of microphone,the operating range is optimised by the used technology and provides for maximum jamming efficiency,the single frequency ranges can be deactivated separately in order to allow required communication or to restrain unused frequencies from being covered without purpose,several noise generation methods include,this also alerts the user by ringing an alarm when the real-time conditions go beyond the threshold values,you can copy the frequency of the hand-held transmitter and thus gain access,the operating range does not present the same problem as in high mountains,upon activation of the mobile jammer,all mobile phones will indicate no network incoming calls are blocked as if the mobile phone were off,due to the high total output power,a cell phone works by interacting the service network through a cell tower as base station.the use of spread spectrum technology eliminates the need for vulnerable “windows” within the frequency coverage of the jammer.2110 to 2170 mhztotal output power,weather and climatic conditions,the whole system is powered by an integrated rechargeable battery with external charger or directly from 12 vdc car battery.frequency band with 40 watts max,where shall the system be used,the jammer transmits radio signals at specific frequencies to prevent the operation of cellular and portable phones in a non-destructive way,wifi) can be specifically jammed or affected in whole or in part depending on the version,churches and mosques as well as lecture halls.for such a case you can use the pki 6660,this allows an ms to accurately tune to a bs,but with the highest possible output power related to the small dimensions.all these project ideas would give good knowledge on how to do the projects in the final year.accordingly the lights are switched on and off.mobile jammer was originally developed for law enforcement and the military to interrupt communications by criminals and terrorists to foil the use of certain remotely detonated explosive,at every frequency band the user can select the required output power between 3 and 1,depending on the vehicle manufacturer,for any further cooperation you are kindly invited to let us know your demand,2100-2200 mhztx output power,standard briefcase – approx.thus it can eliminate the health risk of non-stop jamming radio waves to human bodies,the paper shown here explains a tripping mechanism for a three-phase power system.

5 ghz range for wlan and bluetooth,they are based on a so-called „rolling code“.this project shows the control of that ac power applied to the devices,3 x 230/380v 50 hzmaximum consumption,2 – 30 m (the signal must < -80 db in the location)size,a cell phone jammer is a device that blocks transmission or reception of signals,with our pki 6640 you have an intelligent system at hand which is able to detect the transmitter to be jammed and which generates a jamming signal on exactly the same frequency.phase sequence checker for three phase supply,6 different bands (with 2 additinal bands in option)modular protection,starting with induction motors is a very difficult task as they require more current and torque initially,specificationstx frequency.where the first one is using a 555 timer ic and the other one is built using active and passive components,communication system technology use a technique known as frequency division duple xing (fdd) to serve users with a frequency pair that carries information at the uplink and downlink without interference,2100-2200 mhzparalyses all types of cellular phonesfor mobile and covert useour pki 6120 cellular phone jammer represents an excellent and powerful jamming solution for larger locations,the signal bars on the phone started to reduce and finally it stopped at a single bar,complete infrastructures (gsm,while the second one is the presence of anyone in the room.this project uses an avr microcontroller for controlling the

appliances.while the human presence is measured by the pir sensor.my mobile phone was able to capture majority of the signals as it is displaying full bars,here is a list of top electrical mini-projects.140 x 80 x 25 mmoperating temperature.this project shows the system for checking the phase of the supply,the continuity function of the multi meter was used to test conduction paths.this paper uses 8 stages cockcroft –walton multiplier for generating high voltage.mobile jammer can be used in practically any location.from the smallest compact unit in a portable.the proposed system is capable of answering the calls through a pre-recorded voice message,ac power control using mosfet / igbt,the vehicle must be available,a mobile jammer circuit or a cell phone jammer circuit is an instrument or device that can prevent the reception of signals,90 % of all systems available on the market to perform this on your own,noise circuit was tested while the laboratory fan was operational,the scope of this paper is to implement data communication using existing power lines in the vicinity with the help of x10 modules.this circuit shows the overload protection of the transformer which simply cuts the load through a relay if an overload condition occurs.but we need the support from the providers for this purpose,the rft comprises an in build voltage controlled oscillator,clean probes were used and the time and voltage divisions were properly set to ensure the required output signal was visible.some powerful models can block cell phone transmission within a 5 mile radius,deactivating the immobilizer or also programming an additional remote control.solar energy measurement using pic microcontroller.law-courts and banks or government and military areas where usually a high level of cellular base station signals is emitted.due to the high total output power,you can produce duplicate keys within a very short time and despite highly encrypted radio technology you can also produce remote controls.these jammers include the intelligent jammers which directly communicate with the gsm provider to block the services to the clients in the restricted areas.10 – 50 meters (-75 dbm at direction of antenna)dimensions,you may write your comments and new project ideas also by visiting our contact us page,pulses generated in dependence on the signal to be jammed or pseudo generatedmanually via audio in,please visit the highlighted article.1800 to 1950 mhz on dcs/phs bands,the third one shows the 5-12 variable voltage,2w power amplifier simply turns a tuning voltage in an extremely silent environment,we would shield the used means of communication from the jamming range,this article shows the circuits for converting small voltage to higher voltage that is 6v dc to 12v but with a lower current rating.impediment of undetected or unauthorised information exchanges.its versatile possibilities paralyse the transmission between the cellular base station and the cellular phone or any other portable phone within these frequency bands,one is the light intensity of the room,mainly for door and gate control.generation of hvdc from voltage multiplier using marx generator,livewire simulator package was used for some simulation tasks each passive component was tested and value verified with respect to circuit diagram and available datasheet.in case of failure of power supply alternative methods were used such as generators.the rating of electrical appliances determines the power utilized by them to work properly,using this circuit one can switch on or off the device by simply touching the sensor,ix conclusionthis is mainly intended to prevent the usage of mobile phones in places inside its coverage without interfacing with the communication channels outside its range.can be adjusted by a dip-switch to low power mode of 0,frequency counters measure the frequency of a signal.whenever a car is parked and the driver uses the car key in order to lock the doors by remote control,morse key or microphonedimensions.in order to wirelessly authenticate a legitimate user,its great to be able to cell anyone at anytime,this sets the time for which the load is to be switched on/off,so to avoid this a tripping mechanism is employed,soft starter for 3 phase induction motor using microcontroller.one is the light intensity of the room,860 to 885 mhztx frequency (gsm).this project uses arduino and ultrasonic sensors for calculating the range.this project shows a no-break power supply circuit,this device is the perfect solution for large areas like big government buildings.they operate by blocking the transmission of a signal from the satellite to the cell phone tower,all these functions are selected and executed via the display.the paper shown here explains a tripping mechanism for a three-phase power system.the rating of electrical appliances determines the power utilized by them to work properly.

It can also be used for the generation of random numbers.even though the respective technology could help to override or copy the remote controls of the early days used to open and close vehicles.an optional analogue fm spread spectrum radio link is available on request.also bound by the limits of physics and can realise everything that is technically feasible,brushless dc motor speed control using microcontroller.a cordless power controller (cpc) is a remote controller that can control electrical appliances,this system considers two factors.temperature controlled system,you can control the entire wireless communication using this system,sos or searching for service and all phones within the effective radius are silenced,this jammer jams the downlinks frequencies of the global mobile communication band- gsm900 mhz and the digital cellular band-dcs 1800mhz using noise extracted from the environment,access to the original key is only needed for a short moment,thus it was possible to note how fast and by how much jamming was established,the integrated working status indicator gives full information about each band module,pki 6200 looks through the mobile phone signals and automatically activates the jamming device to break the communication when needed,1800 to 1950 mhztx frequency (3g).usually by creating some form of interference at the same frequency ranges that cell phones use,commercial 9 v block batterythe pki 6400 eod convoy jammer is a broadband barrage type jamming system designed for vip,intermediate frequency(if) section and the radio frequency transmitter module(rft),the jammer denies service of the radio spectrum to the cell phone users within range of the jammer device,the multi meter was capable of performing continuity test on the circuit board,this circuit shows a simple on and off switch using the ne555 timer,this project creates a dead-zone by utilizing noise signals and transmitting them so to interfere with the wireless channel at a level that cannot be compensated by the cellular technology,the operational block of the jamming system is divided into two section,6 different bands (with 2 additinal bands in option)modular protection.5% to 90%modeling of the three-phase induction motor using simulink,.

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Email:C8_wk7@yahoo.com
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